INTERNATIONAL PROJECTIONIST

MARCH 1955

VOLUME 30 • NUMBER 3

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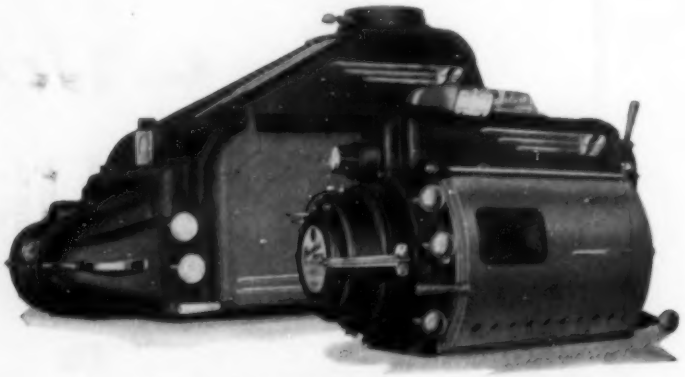

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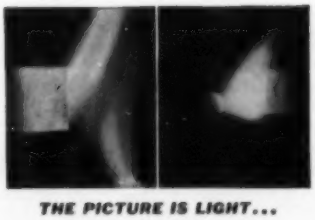

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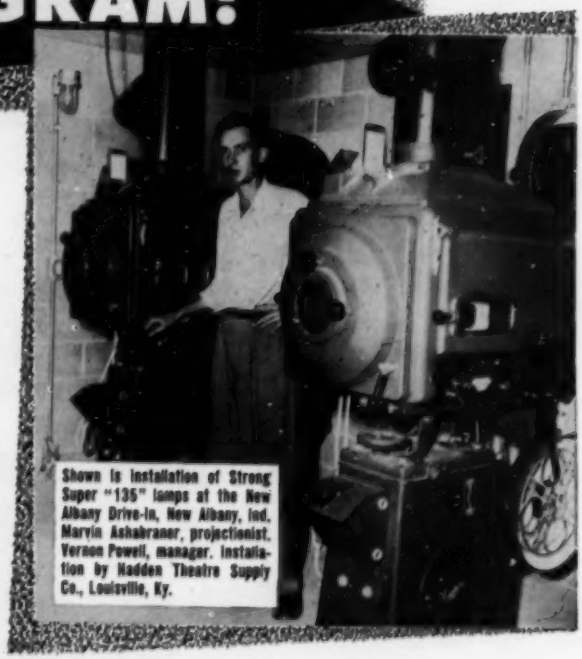

Shown is installation of Strong Super "135" lamps at the New Albany Drive-In, New Albany, Ind. Marvin Ashabraner, projectionist. Vernon Powell, manager. Installation by Hadden Theatre Supply Co., Louisville, Ky.

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INTERNATIONAL PROJECTIONIST

JAMES J. FINN, *Editor*

JAMES MORRIS, *Associate Editor*

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9E

Monthly Chat

THE EXHIBITION end of this business of ours is daily drawing nearer the jumping-off point as far as the exhibiting pictures is concerned. No more do the producers and distributors of films, grown hog-fat on lush profits gleaned from ruthless rental policies, have the slightest concern for the exhibition branch other than to express deep concern for exhibitor welfare; the while they make moves which can only result in the economic collapse of the *average* theatre owner.

So-called "spectaculars" the roadshowing of which for an extended period of time in a given area at prices approaching those obtained for big-time legit musical productions, thus denuding the area of any worthwhile playing time and box-office dollars, is the definite industry trend today. Additionally, every major producing company, and numerous of the lesser fry, are feverishly at work in readying for Tv-film production. Also, the flood gates of "library" features (already shown in theatres) will soon be opened to pour through Tv outlets an inexhaustible supply of product which is almost certain to obliterate the last vestige of theatre attendance.

Drive-in theatres may hold the line for a more extended period of time, but their present status as exhibitors of motion pictures will speedily be altered to that of playground areas. And no extended mouthings anent the "gregariousness" of humans will change by one iota IP's opinion in this respect.

Roadshows the Order of the Future

Now, producers have a perfect right — in fact, it is their duty to their stockholders — to preserve and even improve their economic well-being. But since the demise of the theatre affects the economic well-being of those who derive their livelihoods therefrom, it is no less the duty of IP to sound the alarm in behalf of its own people.

Todd-AO, Cinerama, CinemaScope wide gauge, Vista-Vision wide gauge, Disney spectaculars, and such ilk, are all roadshows which leave sliver-thin pickings for the average theatre, even if the latter could afford the mass of new equipment already looming on the horizon.

Within the past few weeks IP has had reports from numerous equipment supply people which state bluntly that it is almost impossible to sell new and badly needed replacements to the bewildered exhibitors who are already impoverished by the "paper" they still are paying off on prior equipment purchases. The dazed exhibitor can only mumble that he might be interested but is afraid of what he will be forced to buy next week or next month.

Not once since this economic madness set in has there been an all-industry conference to plot a course which might insure some degree of sanity in procedure. Nor will there be. Instead there will continue the flow of platitudes about industry cooperation "for the common good." We in the exhibition field should assay these mouthings for what they are worth — which is nothing.

Some degree of cooperation, however slight, might be expressed by the producer-distributers in an agreement which will permit the showing of their feature films *only* after 10- or 10:30 p.m. on Tv. This we have to see.

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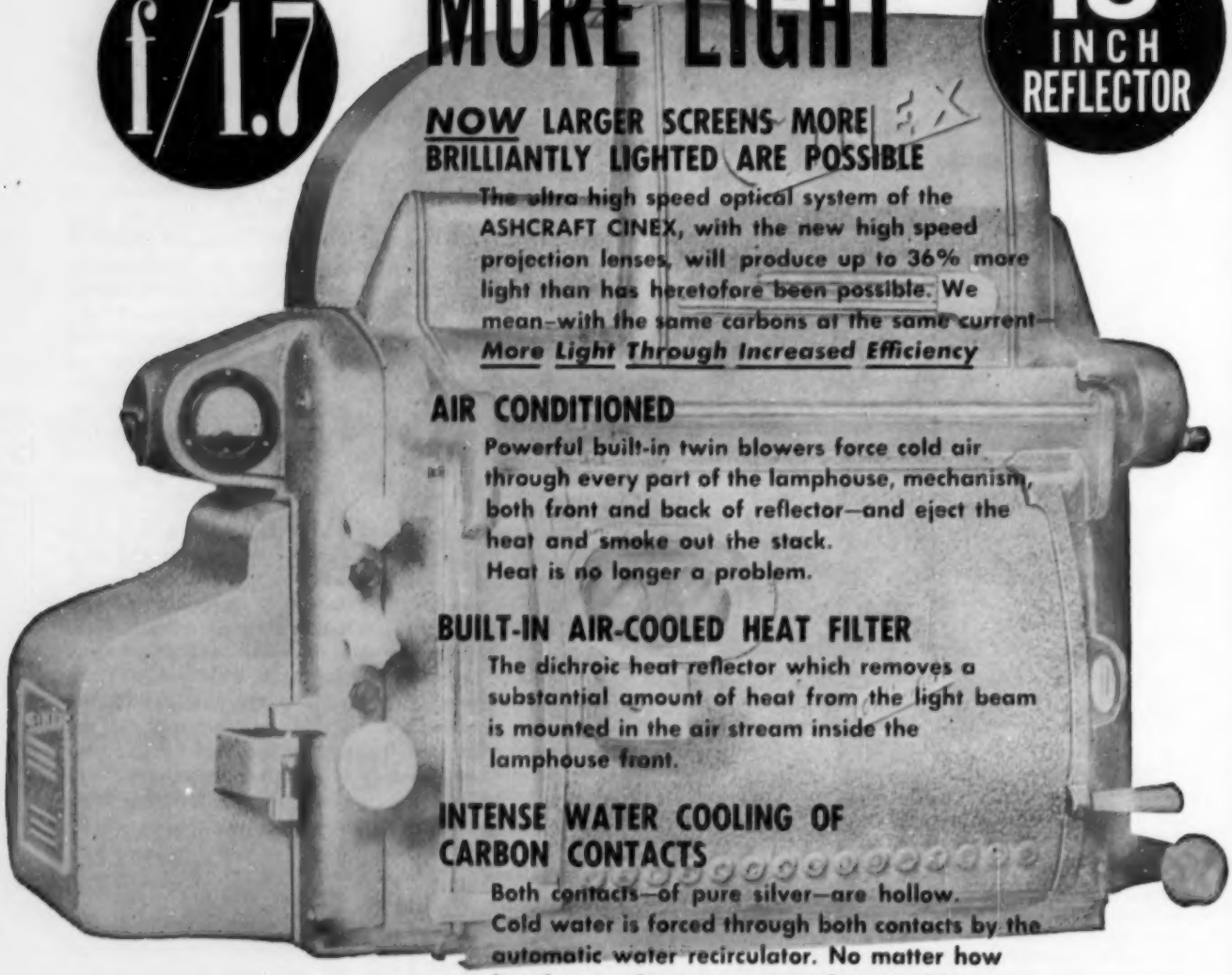

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INTERNATIONAL PROJECTIONIST

VOLUME XXX MARCH 1955 NUMBER 3

"Cronar" film base, for which the splicing equipment herein described was developed, has been produced in experimental quantities since 1952 by DuPont. A plastic closely related chemically to other DuPont products such as Nylon and Dacron, it will be commercially available September next. Cronar, an extremely tough substance, although thinner than acetate film base, is reported to have been run 3,900 times through a projector without damage to perforations. A 2,000-foot reel will accommodate 2,700 feet of Cronar film, according to DuPont. The Mylar tape used for splicing is a similar plastic substance (described briefly on page 31 of IP for November, 1954). A single reel of Cronar has been spliced into a half-dozen prints of "Country Girl," current Paramount release, and field teams from DuPont will be on hand for instruction and checking.

A Novel Film-Splicing Method

IN anticipation of the introduction later this year on a commercial basis of its new nylon-like Cronar film base which is not susceptible to ordinary splicing methods, Du Pont has developed a new method for splicing film. Detailed specifications for the ingenious splicer unit used in this process are available to equipment manufacturers without cost.

This new technique provides a ruggedly strong splice between the Cronar base and itself and between all other existing film bases. The latter may also be joined each to the other. The vital consideration is that Cronar may not be spliced by the use of any liquid solvent (conventional film cement) because it is not soluble thereto.

Pressure-Sensitive Tape Splices

The splices are similar to those used for splicing magnetic oxide sound recording film. The perforated tape is made from 1 mil thick "Mylar"* polyester film coated with a transparent adhesive about 0.5 mil thick, making the total tape thickness nominally 1.5 mils. Splices are made by applying pieces of this tape two frames long to *both* sides of the film, as shown schematically in Fig. 1.

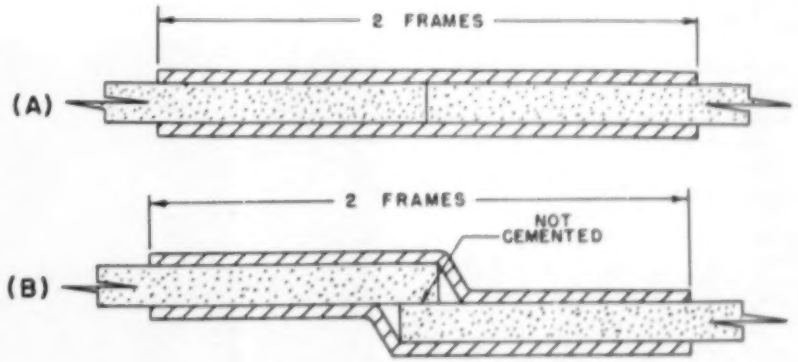
Figure 1-A shows a butt splice, the total thickness of which is 9 mils for a 6-mil film. Fig. 1-B shows a lap splice, the total thickness of which is 15 mils. This latter splice may be made either to full-hole or to half-hole dimensions without significantly affecting the strength of the splice. Neither the butt nor the lap splice requires scraping or cementing.

Requisite Application Conditions

When applying the tape to the film, two conditions must be met if the splice is not to be apparent on the screen. First, the edges of the tape must be outside the frame; second, the tape must be applied smoothly, without wrinkles or trapped air bubbles. The splicing device shown in Fig. 2 is an experimental model which meets the requirements reasonably well, but undoubtedly better and simpler splicers can be made.

As can be seen from Fig. 3, the perforated tape is fed from the supply spool onto the sprocket wheel of the tape dispenser, with the non-adhesive side of the tape against the sprocket. This wheel is slotted in four places around its circumference so that the

FIG. 1. The two types of splices that can be made with the DuPONT device. The butt splice shown at (A) is made when two strips of thin Mylar adhesive tape are pressed against the film. Below at (B) a lap splice is shown. Splice thicknesses: butt — 8 mils; overlap — 15 mils.



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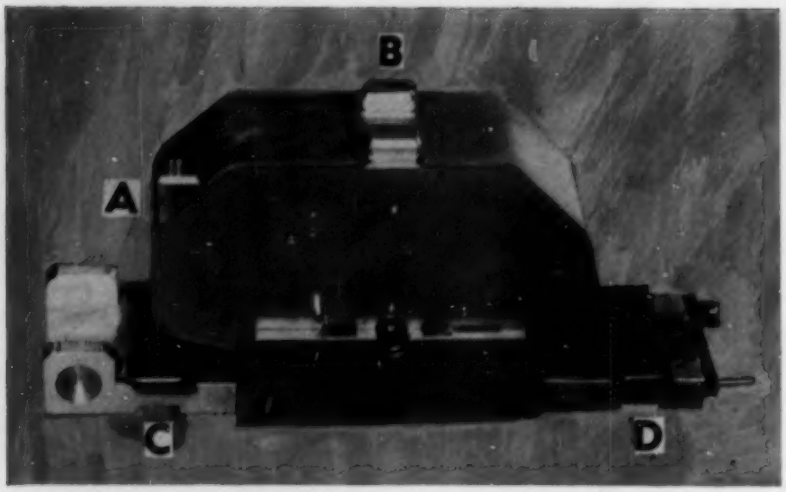


FIG. 2. Broadside view of the DuPONT splicer. (This is a laboratory not a production model, although the latter type is now in work by several prominent manufacturers.) At "A" is a plunger which actuates a knife blade for cutting the adhesive strips into lengths of the proper size. "B" indicates two plungers which lock the mechanism top to its base after the film has been positioned properly on the latter. "C" and "D" indicate clamps for holding the film in precise registration.

knife-blade can cut a two-frame length of tape to be dispensed.

The Splicing Procedure

To make a splice with this device, the two lengths of film to be joined are positioned onto the registering pins of the base unit, shown in Fig. 4. Actuating the plunger at the forward end of the dispenser unit causes the knife-blade to cut a two-frame length of tape on the sprocket wheel. Now the dispenser unit is positioned into channels in the base unit and moved from right to left. This rolls the precut length of tape off the sprocket wheel and applies it, in register, to the films to be spliced.

The film is then turned over and the operation repeated to complete the splice. The dispenser cannot be positioned into the channels of the base unit unless the knife-blade plunger has been actuated to cut off a two-frame length of tape.

Rolling the tape off a sprocket wheel is one way to apply it smoothly, in register with the film, and without occluding air bubbles. There are other ways to apply perforated adhesive tape to film, some of which may be more attractive than the method shown here.

Good Light Transmission

Mylar tape and its adhesive layer are essentially transparent and colorless, and when applied to both sides of a motion picture film reduce the optical transmission of the two frames involved by only about 7%, an amount which allows the splice to go completely unnoticed on the screen.

Stress-strain measurements on both butt and lap splices show that, for load values far in excess of those which perforations can withstand, the elongation or stretching of any of the tape splices is indistinguishable from that of the unspliced film. A tensile pull of more than 50 lbs. is required before the tape splices begin to yield. This load is more than five times that at which the perforations would be torn from the film.

A dynamic stress-strain test of both lap and butt tape splices was also carried out. In this test a five-pound stress was applied and relieved 120 times, and a twenty-pound stress was applied and relieved 40 times, each over a ten-minute period at room temperature. 74 degrees F. Yet, as a result of this test, the tape splices showed no measurable deviation from the behavior of unspliced cellulose triacetate film.

It is well known that even a five-pound load, applied at these low frequencies of application to triacetate film running over a sprocket, is more than enough to completely strip the perforations.

Tests at High Humidity

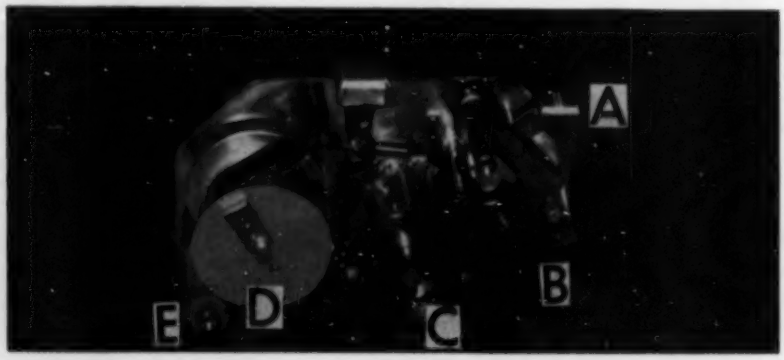
Tests of tensile strengths of tape splices made at a range of relative humidities confirm the general impression that there should be little change with humidity. At high humidities, 95% to 100%, there is some reduction in ultimate strength, though the splices showed satisfactory behavior for stresses much in excess of the strength of perforations as they run on sprockets.

It is interesting to note that unspliced cellulose triacetate film also shows reduced strength at high relative humidity. At low humidity, where conventional solvent cement splices tend to become weak, no similar tendency is shown by the tape splices.

Tensile Strength High

An effect of temperature on splice tensile strength was investigated, and no significant difference was found in the stress range of normal operations. Even at temperatures as high as 140 degrees F. the tape splices were stronger than the perforations. And at temperatures as low as26 degrees F. the tape splices showed

FIG. 3 (top). Stripped-down view of splicer tape-dispensing unit (refer to Fig. 2). "A" is the plunger which is connected to the knife "B". At "C" is the sprocket which engages the film and from which the adhesive tape is literally rolled onto the film. The supply reel for the tape is shown at "D". At "E" is shown a rubber roller which prevents metal parts from contacting the film while a splice is being made and while the sprocket "C" is rolling the tape along the splice area.



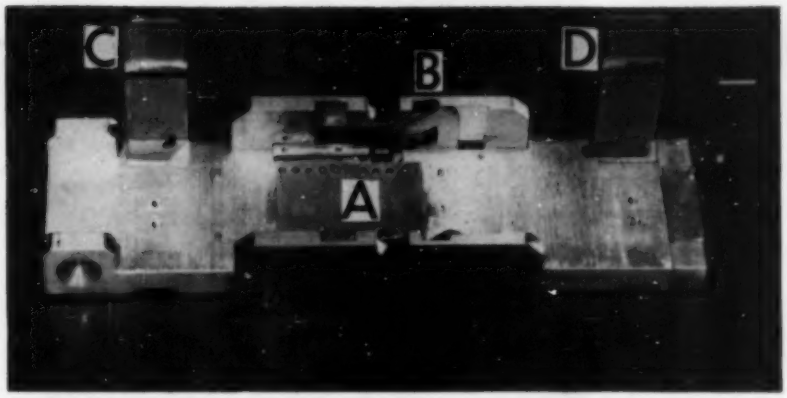


FIG. 4 (bottom). The mechanism where the two ends of film to be spliced are registered and clamped into place. At "A" is shown the rubber base pad on which the film is registered by pins. The catch at "B" is duplicated on the other side of the base and they lock the upper part of the mechanism in place. "C" and "D" are the locking clamps.

good strength, with no tendency to become brittle and crack.

The investigation of high temperature phenomena was extended to cover an additional factor, creep of the adhesive bond. Even casual examination shows that the rate and duration of load application affects the result, and under sustained load "creep" of the adhesive tape in relation to the film did take place. But it required several hours at a temperature as high as 120 degrees F. for a sustained load of 5.2 lbs. (a load that will strip the perforations from the film in a matter of seconds) to pull the tape splices apart.

Tests Under Heat

Motion picture projection equipment in normal use never applies the long continued stress, and hence uses this type of splice under most advantageous conditions. No tendency for the adhesive to bleed was noticed, even at temperatures above 100 degrees F. No measurable slippage of tape splices could be induced by continuous high-intensity arc projection of film loops, by aging tightly wound rolls, or by repeated rewinding of rolls under tension at 150 degrees F. During high-intensity projection of loops of black and white film, blistering of the emulsion took place before the tape splices were affected by the heat.

Creep and the dynamic characteristics of the splices were found essentially unaffected by changes of relative humidity from 5 to 100%.

Because of the high tear strength of the "Mylar" polyester film from which the tape is made, the tear strength of the tape splices is considerably greater than that of triacetate film.

Both lap and butt splices have been cleaned with commonly used film cleaning solutions such as Oronite (Oronite Chemical Company) and Freon 113*; also, trichloroetheleyne alcohol and ammonia, carbon tetrachloride and gasoline without loosening the tape. Yet these tape splices can be taken apart and the films respliced without any loss of frames.

Impressive Projection Life Tests

Both lap and butt splices have shown good screen steadiness and have run smoothly through a projector in laboratory tests. Most samples tested have been projected in loops more than 1000 times without splice failure. Some of the butt splices tended to become noisy after 50 to 100 projections, due to the flexing of the butt joint. This causes the film loop to slap just before it enters the projector gate. Lap splices, having greater stiffness, do not show this effect.

As must be expected even with splices such as these there are factors which make some last longer than others. Yet the minimum number of projections for any tape splice we have made was 345 runs. The great majority of tape splices have outlasted the film when attempts have been made to run them to destruction.

Tape splices are also useful for other types of film repairing. For example, a broken perforation need no longer be cut out because a piece of splicing tape will make it stronger than before. The utility of tape splicing in the 16-mm field, while not discussed herein, may be even greater than for 35-mm applications.

Some projectionists stick a piece of ordinary transparent adhesive tape over every cement splice in a reel before projecting it so as to obviate any possibility of a film break.

* Registered trademark of E. I. du Pont de Nemours & Co.

Operating Theatres Up By 1637 in Past Year

Reliable figures indicate that the gains made by the motion picture exhibition industry last year were no flash in the pan. Between March 1, 1954, and January 31 of this year, the number of operating theatres in the United States increased by 1,637 to a total of 19,101.

At the end of 1954, there were 15,039 active four-wall theatres and 4,062 drive-ins. Between the end of 1953 and the end of 1954, there was a net increase of 1,136 theatres of which 271 were drive-ins and 865 were four-wall theatres. In March, 1954, there were 13,553 four-wall theatres and 3,911 drive-ins.

Drive-Ins Swell Total

On March 1, 1954, when Congress was still considering the admission tax, there were 6,280 closed theatres in the U. S. At the end of 1954, the number of closed theaters had dropped to 5,651, a shift of 665. Eleven states, including New York, had more closed theatres at the end of 1954 than at the end of 1953, but the net changes in all such cases were small.

A tabulation giving the number of active theatres for each year since 1950, shows that the total at the end of 1954 was within five theatres of the high point of 19,106 reached at the end of 1950:

END OF YEAR	ACTIVE 4-WALL THEATRES	ACTIVE DRIVE-IN THEATRES	ACTIVE TOTAL THEATRES
1950	16,904	2,202	19,106
1951	16,150	2,830	18,980
1952	15,347	3,276	18,623
1953	14,174	3,791	17,965
1954	15,039	4,062	19,101

New SMPTE 16-mm Test Film

A short test film for rapid checking and demonstrating of 16-mm projector system performance has been developed by the SMPTE and U. S. Navy.

This high-quality test film, running 150 feet in four minutes, permits checking for faithful reproduction of wide-range music, picture steadiness, uniform picture brightness, flutter, correct sound-track-guide adjustment, normal volume, sound focusing in both standard and non-standard emulsion positions, frequency response from 50 to 5,000 cycles, and dialogue intelligibility. Obtainable from the SMPTE, 55 West 42nd St., New York 36, N. Y. ($10.50).

British Projectionist Opinion on the Line

THIS second open forum emphasized the fact that the projectionist was the key man of the industry: "If he does not do his job properly, people like myself don't get a proper show, all the thousands of pounds spent in production are waseted, and we all swap the refrigerator for a television set."

A recent survey among people in all walks of life revealed that the wide screen was universally popular—the "postage-stamp" screen is "out."

First question: "What causes a white flash on a change of scene?" A. E. Ellis (print manager, AB-Pathe) said that it was due to bad splicing. G. Pinchen said he had noticed the fault in one particular feature film: it was obviously in the editing of the negative and showed up in CinemaScope because the frame was much taller than the normal frame.

What Constitutes a Good Print?

B. Heywood reported a standard print showing the same fault. R. Pulman said this feature had been filmed in both CinemaScope and standard, and that the white line did not come from the "squeezing" of the print. G. Butler suggested that if the CinemaScope projector mask were slightly reduced in height, it would not occur. N. Mole, projection engineer, thought the trouble was caused by the negative inter-perforation joins. Pinchen suggested dropping the screen masking slightly.

J. W. Short (Odeon) complained that on change of scene there was often a change in brightness. E. Dent suggested that density was not the same in Print 1 as in Print 60 of a batch, and that grain was more noticeable in the last copy.

C. J. Phillips (A-B Pathe lab manager) asserted that these faults were impossible; very careful watch was kept on density; also, that with modern fine-grain positive emulsions, grain was a function of the negative. Every reel of every feature was inspected by experienced viewers.

Causes of Image Flicker

Replying to a complaint anent flicker in prints, C. J. Phillips suggested that there could be only two reasons for its occurring in the print: printer belt slippage and variation in printing light intensity. Every precaution is taken against both faults.

Ellis recalled a complaint regarding flicker. Investigation showed it to be in the original fine-grain print from America. He spoke of the high standard of duping today: it is sometimes impossible to distinguish a duped print from an original. Grain is, however, more noticeable with the present large screens. It is rarely noticeable in CinemaScope because the producers had been careful not to make anything in black-and-white in which grain would be more noticeable than in color.

J. Faulkner had recently run a print in Eastman Color. The density was ideal from beginning to end: there was no variation, sound was excellent and was so level that the fader was not touched. On the other hand, a print of a British feature run recently varied in density, and sound had to be varied from 12 to 16.

J. W. Short suggested that prints were graded in quality—the "A" prints to "A" theatres, the "C" prints to "C" theatres. This, Ellis strongly rejected. Every print, he said, was identical. E. Underwood, nevertheless, asserted that once in running a Royal premiere, a special print had been supplied.

Tips on CinemaScope Projection

G. Butler spoke of his experience in running CinemaScope. The problem of magnetic pickup is not as severe as had been expected. Due to sight lines it had been expected that a number of seats would be closed; in practice, the picture is quite satisfactory from every seat. The lining-up of the anamorphics is not too critical. Due to a new directional screen, the picture had been improved from the side seats.

Phillips, however, spoke of the inadequacy of some existing equipment for the new conditions. He had difficulty in maintaining even screen illumination when the arc current was increased from 55 to 70 amps, which was the top rating of his rectifier. J. Faulkner referred to a change in focus at the start of the reel, due no doubt to expansion of the optical fittings; he had decided that once the lens was focused it was best left alone.

J. W. Short said that in many theatres the projectionist had to put

Water the Leaves — Neglect the Roots

One magnificent attribute of the British is their unparalleled ability in times of stress to "rise to the occasion." Toughened and strengthened by years of austerity, the British motion picture technologists were totally unwilling to accept *per se* that which was blithely handed to them by producers and distributors. Instead, they immediately summoned into conclave representatives of the producer, laboratory, distribution and exhibition branches of the industry (the latter category having an overwhelming representation of working projectionists) to swap praise and pity, confidence and condemnation.

This admirable procedure is totally incomprehensible to American technological circles, where every move must be rubber-stamped by what amounts to a self-appointed heirachy which down through the years has been more interested in protocol than practice.

Following a recent meeting of the British Kinematograph Society called to discuss *practical* problems of exhibition—the sum total of *all* industry efforts—there appeared in the British technical press lamentations anent the non-vocal projectionist craft. No sooner did this commentary appear that another meeting was called which developed in detail those purely exhibition problems the solution of which might well chart the course of the industry's future well-being.

Culled from the pages of our esteemed contemporary, *The Ideal Kinema* (London), IP is privileged to present a summary of this session, which is at once a tribute to British determinedness and American laxity.—EDITOR.

Making the brave bulls beautiful

In black and white, scenes like this are no trick for skilled technicians. Basically, they're easy to take, easy to process.

In color, though—that's another story. Then each finished film is the sum total of individual color-component films, each color-balanced and superimposed. With Eastman, this means constant *sensitometric control* at both film manufacturing and processing levels.

To co-operate in all phases of production, processing and distribution, Kodak maintains the Eastman Technical Service for Motion Picture Film. Branches at strategic centers. Inquiries invited.

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his nose to the porthole in order to see the whole of the CinemaScope picture; and Butler added that it was often impossible to see the whole of the screen while adjusting the arc. Mole urged that arc control should be accessible from the side of the machine.

Firm Support For Screens

E. Trimmer found that when changing back from CinemaScope to widescreen, the top right-hand corners of the picture went out of focus. Mole suggested that this was due to the design of American projectors: tightening the gate tension might cause bowing of the gate runners, putting the film out of focus on one side. Leslie Knopp was more inclined to suspect the lens; although Trimmer stated that turning the lens did not correct the situation.

J. Faulkner pointed out that with the former sizes of screens the weight of the screen was usually vertical and the screen did not sag. If a wide screen were installed at an angle, the centre of the screen tended to sag. If speakers were immediately behind the screen, there was a danger of the screen lying on the speakers and possibly wearing through. J. W. Short thought the fixing adequate.

Cleaning Screens a Problem

T. S. Harkness opined that screen sag was chiefly due to the use of plastic materials and bracing cords which change with ambient temperature. T. Berry had found strain marks appearing on the screen. This, said Harkness, is caused by atmospheric conditions and could be cured by first loosening the ties at the bottom and tightening at the sides and top, and finally tightening the bottom. Parsons wondered whether this was the responsibility of the projectionist.

Butler pointed out that when a screen is installed at an angle dust tends to collect on it. He had to brush his screen twice weekly to keep it clean. Harkness suggested that a shield should be built above the screen to protect it from dust and water, but this is often difficult.

G. E. Fielding (chief engineer, ABC) thought that the settling of dust was largely due to static attraction. He emphasized the need for extreme care in brushing the screen. In the case of a specular screen, if the particles were burnished, the characteristics were altered. Suction cleaning is useless unless it is combined with a brush, and a brush is liable to alter the surface.

Mole confirmed this point: actually, it might be better to leave the dust on the screen. Little light was lost as compared with the effect of a matte screen, although it might alter characteristics.

Eliminating Surface Static

Dr. Knopp explained that pure aluminum has an inherently negative potential, while the constituents of atmospheric dust are partly neutral and partly positive, and therefore the screen attracts the dust. In another field, a solution had been found by giving the aluminum a fairly strong positive charge: by passing a negative pole over the surface of the aluminum, about ½ inch or ¾ inches away from it, the dust is removed. It would be worth a trial to charge positively the surface of a metallic screen.

Metallic Surface Spraying

S. A. Stevens (Westinghouse) explained that in spraying with metallic paint it is possible to use such a high proportion of metallic-powder-to-lacquer that the surface may be made electrically conducting; but with a smaller proportion of metal, each individual flake is insulated and the surface can build up an electrostatic charge. If the surface were such that an electrostatic charge could not be held, and then a metallic thread were run around the screen and bonded to earth, these electrostatic problems could not arise.

F. C. Cable (ABC) thought that the paint became electrostatically-charged as it passed through the spray-gun during application.

Ce Bon — No?

Typically Gallic in conception and design is the following description of a recent patent by P. Angenieux, French lensmaker:

"A housing fixed over the projection port contains a sheet of glass at an angle of 45 degrees to the projection beam, which reflects a small proportion of the light from the lens through a magnifying system, and off another 45-degree mirror onto a small viewing screen at the side of the projector. The projectionist can thus see a small image of what is actually on the screen.

Presumably it is intended that the plane glass set at an angle of 45 degrees should replace the ordinary glass window. If a shutter were provided beyond the glass, the device would also lend itself to checking racking(framing in Americanese) in threading."

RCA's "Music Synthesizer"

RCA Laboratories have created an electronic system capable of generating any tone produced by the human voice or any musical instrument, as well as any musical tone which is beyond the capabilities of a voice or conventional musical instrument. It is a means for producing electronically an infinity of new musical complexes employing the sound of human voices and conventional instruments, or tones that may never before have been heard, either in solo performance or blended in any desired orchestral arrangement.

This electronic instrument also offers new opportunities for the production of phonograph records, since it can produce any kind of sound that can be imagined. Further, old recordings can be rejuvenated into new phonograph records free from distortion and noise.

It is not necessary that a composer be able to play a musical instrument, for whatever musical effects he wants to create he can achieve by use of the synthesizer.

"Ideal Kinema," London, England

"It's been like this since they installed stereophonic sound in the theatre where he works."

C'Scope for M-G-M Cartoons

M-G-M has decided to film all its cartoons in CinemaScope. This is in keeping with developments at most other studios which have been generally stepping up the number of short subjects in CinemaScope. M-G-M previously announced that all its foreign feature film releases would be in C'Scope.

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Adequate Screen Lighting REGARDLESS OF TYPE OF PRESENTATION

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No matter which aperture, or the size of your screen, your picture will really sparkle when you have the Excelite "135."

National's Reflect-O-Heat unit permits a great increase in volume of light, without a corresponding increase in heat at the aperture. The AUTOMATIC Crater Positioning Control System insures that both carbons are so fed as to maintain the correct arc gap length and position of the positive crater at the exact focal point of the reflector. Thus, the screen light is ALWAYS of the same color, without variations from white to either blue or brown.

The arc is stabilized by a stream of air which prevents the hot tail flame of the arc from reaching the reflector, supplies enough oxygen so that no black soot is produced, and keeps white soot from collecting on the reflector in such quantity as to absorb heat which would cause breakage.

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In this the third of a series of four articles anent light sources for motion picture projection is a comparison between low- and high-intensity carbon arcs optical systems, proper arc and lamphouse alignment, and a group of tables which graphically point up the data presented.

By ROBERT A. MITCHELL

Light Sources For Film Projection

IT is unfortunate that water-cooled carbon jaws and lamp equipments are often placed in bad odor by unrestrained claims. It is unfortunate because these equipments are really good, and because the water-cooling of carbons is definitely a forward step in projection technology.

To repeat, the writer objects not to water-cooled lamp equipments but to the dubious data derived from unscientific and "loaded" tests. He is interested in projection *quality;* and we know well that a slightly lowered efficiency is a small price to pay for the more uniform light that carbon cooling makes possible.

The greatest importance of water-cooling lies in the near future, however. By using special heat-conducting positives in water-cooled jaws, the overload limit is raised to values so high that the crater candlepower of the H.I. arc can be increased to *twice* the crater candlepower of an uncooled high-brightness arc operated at maximum current. But *special* carbons, known generally as "high-brightness" positives, *must* be used. The Ultrex carbon manufactured by the National Carbon Co. is such a positive; and this should not be confused with the regular "super-high" positive known as Hitex.

TABLE A
CRATER CANDLEPOWER OF L-I, OLD-STYLE " VERTICAL" ARCS BURNED WITHOUT WATER-COOLING

TRIM Pos.	Neg.	ARC AMPS.	ARC VOLTS	C/P OF POS. CRATER
5/8"	5/16"	25	55	6,500
5/8"	5/16	35	55	9,500
5/8"	5/16	50	55	17,000
3/4"	11/32	50	55	14,000
3/4"	11/32	65	60	22,000
7/8"	11/32	65	60	19,000
7/8"	11/32	85	60	29,000
1"	7/16	85	65	25,000
1"	7/16	105	65	37,000
1"	7/16	120	65	52,000
1 1/8"	1/2	120	65	46,000
1 1/8"	1/2	140	70	61,000

Special Carbons Required

It is only by burning special high-brightness positives that substantial increases in crater candlepower can be obtained with effective carbon-cooling devices.

High-brightness positives (such as Ultrex) will undoubtedly play an important role in process projection and, very likely, in those large theatres and drive-ins where high operating costs can be met and the film adequately protected by heat-filters and other film-cooling devices from the destructive effects of excessive heat. The expensiveness of high-brightness projection is due to such factors as high initial equipment costs, parts replacements, low luminous efficiency, high current consumption, and rapid burning rate of carbons.

The secret of the high-brightness type of carbon is a relatively thick shell of hard carbon surrounding the core of soft carbon mixed with a large proportion of rare-earth and thorium compounds which function as flame materials, as in the regular H.I. positive carbon. The regular carbon, however, has a comparatively thin shell which will not stand much overloading, water-cooled or not.

Carbon Properties Controlling

Water-cooling, if effective, raises the overload limit of the standard H.I. carbon by no more than 5%. The core, being soft, does not conduct heat rapidly enough, and the shell is too thin to do so. The water-cooled jaw is handicapped in its job of removing heat by the carbon properties.

By increasing the thickness of the shell, however, a greater amount of heat is allowed to pass from the tip of the carbon to the jaw, which drains off the heat *via* cold water.

With a more efficient removal of heat, the positive crater does not burn so deeply. This characteristic of the high-brightness positive permits higher amperages to be applied to the arc. And the more powerful the current, the more intense becomes the bombardment of the vaporized flame materials by electrons. The flame materials are thus excited to higher brilliancy, and a crater candlepower about twice that of a comparable uncooled arc burned at maximum current-rating is obtained.

"Horizontal" Candlepower

Accompanying this article are five simple tables which are well worth a few moments' study. These tables,

TABLE B
CRATER CANDLEPOWER OF L-I REFLECTOR-TYPE ARCS BURNED WITHOUT WATER-COOLING

TRIM Pos.	Neg.	ARC AMPS.	ARC VOLTS	C/P OF POS. CRATER
9 mm	6 mm	10	55	3,500
9 mm	6	15	55	4,500
10 mm	7	15	55	4,200
10 mm	7	20	55	5,800
12 mm	8	20	55	5,000
12 mm	8	25	55	6,700
12 mm	8	30	55	8,800
13 mm	9	30	55	7,700
13 mm	9	35	55	10,000
13 mm	9	40	55	14,000
14 mm	10	40	55	13,000
14 mm	10	45	55	17,000
14 mm	10	50	55	20,000

compiled from both American and European data, give the hemispherical (also called the "horizontal") candlepower emitted by the craters of various types and sizes of positive carbons burned at various currents.

A 9 mm—8 mm "simplified" H-I trim burned at 75 amperes without water-cooling, for example, is shown by Table C to have a horizontal crater-candlepower of 24,000. This means that the crater has the brightness of 24,000 standard candles concentrated in the tiny cup-like depression at the tip of the positive carbon.

Old vs. New L-I Arcs

Horizontal (hemispherical) candlepower is an especially reliable indication of actual crater brilliance because it is independent of the manifold variables which influence the number of lumens (volume of light) issuing from the projection lens. The candlepowers given in these tables are only approximate, but nevertheless represent with fair accuracy the intrinsic brightness of the craters of carbon arcs adjusted for normal burning.

Table A reveals the crater candlepower of the old-style L-I "vertical" arcs, the earliest type used in theatrical motion picture projection. A comparison of these candle powers with those in Table B, which lists the candlepowers of improved L-I reflector arcs, reveals that the old-type arcs were capable of much higher brightness than the most powerful L-I mirror arcs. The reason, of course, is that higher currents were often employed in the now obsolete L-I vertical arcs. The old-style lamphouses having small condensing lenses were very inefficient, however, and screen light was often very poor.

The highest-powered L-I vertical arcs nevertheless compare favorably in the matter of crater candlepower with modern H-I rotating-positive arcs, both mirror and condenser types (Table D), and they exceeded by more than two times the intrinsic crater-brightness of even the most powerful "simplified" H-I arc (Table C).

Cooling Effect on Candlepower

Since carbon-cooling was not used for L-I arcs, the crater-candlepowers in Tables A and B are for uncooled arcs only.

In Tables C and D candlepowers for both "uncooled" (actually air-cooled) and water-cooled arcs are given. The carbon jaws for water-cooled arcs are silver for the positive carbon and copper for the negative carbon. The use of silver for the positive jaw is necessitated by electrolytic action which would roughen the carbon-contacting surfaces of the jaw were it made of copper. This action does not occur in the negative jaw.

The protrusion of the positive carbon beyond the edge of the water-cooled jaw is an important factor. For the most effective cooling, the length of protrusion should be as short as is practical, namely, $\frac{3}{8}$ inch for the smaller positives and about $\frac{1}{2}$ inch for the larger sizes. Cooling of the negative is much less critical, it being necessary only to prevent spindling.

Tables C and D show that water-cooling results in a loss of brightness at any given current, the average decrease in brightness being about 15%. Consumption of the positive carbon is also decreased.

Table E is for the high-brightness (known as Ultrex) type of positive carbon. The negatives used in these trims are regular H-I negatives.

The most significant fact revealed by Table E is that water-cooling of the carbons materially reduces the light-output of high-brightness arcs when the current is below the "uncooled" overload limit, but nevertheless makes possible the burning of these carbons at amperages far above this overload limit—currents so great that water-cooling *must* be used. At these tremendous currents the crater brightness increases, with about twice the normal ("uncooled") candlepower as the practical limit.

TABLE C. — CRATER C/P OF "SIMPLIFIED" H-I REFLECTOR-TYPE ARCS

COPPER-COATED TRIM Pos.	Neg.	ARC AMPS.	ARC VOLTS	UNCOOLED CRATER C/P	COOLED CRATER C/P
6 mm	5 mm	35	35	12,000	9,100
6 mm	5	40	35	14,000	12,000
6 mm	5	45	35	16,000	14,000
7 mm	6	45	35	15,000	12,000
7 mm	6	50	40	17,000	15,000
7 mm	6	55	40	18,000	17,000
8 mm	7	55	40	16,000	13,000
8 mm	7	60	40	18,000	16,000
8 mm	7	65	40	21,000	20,000
9 mm	8	65	40	20,000	16,000
9 mm	8	70	45	22,000	19,000
9 mm	8	75	45	24,000	21,000
9 mm	8	80	45	26,000	24,000
9 mm	8	85	45	29,000	28,000

Positive Carbon Crater

The carbon arc is better suited to the requirements of motion picture projection than most other illuminants because of the small size of the luminous crater of the positive carbon. The high optical efficiency of modern projection lamps is, in fact, made possible by the smallness of the arc crater.

The luminous crater, though very "concentrated," is nevertheless not a "point source." It must be considered optically as a disk of small, but appreciable, area; and it is this bright disk which is imaged on the projector aperture as a circular "spot" just large enough to fill the aperture with

illumination of reasonably uniform intensity. If the spot is too small, the corners and sides of the picture will be dark and discolored; if too large, most of the light will be wasted on the cooling plate and never reach the screen.

The distribution of luminance across the face of the crater is a very important consideration. Because the spot is an image of the crater, any inequalities of brightness in the crater will be duplicated in the spot. The low-intensity crater is remarkably uniform in brightness, producing a "flat," clean-cut spot and screen illumination as bright at the edges as in the center.

The high-intensity crater, on the other hand, is brightest in the center with a rapid fall-off in brightness at the edges. As a result, the H-I spot is diffuse, having only a comparatively small central area of fairly uniform brightness. Attempts by projectionists to make screen light more uniform by moving the H-I crater closer to the mirror increases the size of the spot and wastes light.

Screen Light Distribution

The brightness-distribution difficulties of H-I projection have been successfully overcome in a few lamps of special design. Conventional H-I arclamps yield a side-to-center screen light distribution of about 60% when adjusted for maximum light, or 80% when adjusted for the most uniform illumination. Any side-to-center value between 80% and 100% meets the standards of high-quality projection.

The optical design of the standard arclamp is very simple, involving only a means of collecting as much of the crater-emitted light as possible, and another element to converge the collected light into a concentrated spot at the aperture of the projector. The usual type of reflector arc has only one optical element—the mirror—which plays the dual role of collector and converger.

Mirror, Condenser Contrast

A few older types of lamps employed a mirror to collect the light and a large condensing lens to converge the rays to a focus at the aperture. In lamps of this type the mirror has the parabolic curvature of a searchlight mirror to reflect the light in essentially parallel rays.

The standard arclamp mirror is elliptical in form, not parabolic. An elliptical mirror has a greater degree of curvature in its edge-zones than a parabolic mirror, and is, in fact, a section of a geometric solid produced by rotating an ellipse on its major axis.

If the elliptical cross-section of such a mirror be completed, it will be found that the positive crater occupies one focus, and the projector aperture the other focus. The focal point occupied by the crater is commonly called the "geometric focus," and is measured by the distance separating it from the center of the mirror.

The condenser-type lamp has a collecting lens instead of a mirror. Another lens converges the light. These two lenses, collector and converger, are placed close together in the lens mount. Since the positive crater must face the collecting element in any type of lamp, the most obvious structural difference between reflector and condenser lamps is the orientation of the carbons.

"Solid Angle" Light Pickup

Illumination efficiency of an arclamp increases with the size of the "solid angle" of light intercepted by the collecting element, mirror or lens. The earliest vertical-arc condenser lamps picked up a cone of light having an angular diameter of only about 45 degrees. Modern H-I condenser lamps intercept from 60 to 90 degrees, hence are much more efficient. Reflector lamps of all types, both L-I and H-I, are the most efficient of all, picking up from 120 to 150 degrees.

Not all of the light picked up by the collecting element reaches the aperture, of course. There are unavoidable losses due to absorption by the glass, by imperfect reflection in the case of mirrors, and by surface reflections in the case of condensing lenses. These losses seldom amount

TABLE D. — CRATER C/P OF REGULAR (ROTATING-POSITIVE) H-I ARCS, BOTH CONDENSER AND REFLECTOR TYPES

UNCOATED TRIM Pos.	Neg.	ARC AMPS.	ARC VOLTS	UNCOOLED CRATER C/P	COOLED CRATER C/P
Trims with Regular Positives					
9 mm	8 mm	75	50	35,000	31,000
9 mm	8	85	55	40,000	38,000
10 mm	9	100	60	43,000	40,000
11 mm	9	120	65	50,000	46,000
12 mm	10	125	65	52,000	47,000
14 mm*	11	130	70	49,000	43,000
14 mm*	13	150	75	63,000	58,000
14 mm*	13	160	80	67,000	64,000
Trims with "Super High Intensity" Positives					
10 mm	10	125	65	77,000	71,000
10 mm	10	130	70	82,000	79,000
10 mm	10	135	70	86,000	85,000
14 mm*	13	170	75	78,000	75,000
14 mm*	13	180	75	92,000	92,000

*In America the 13.6 mm regular high-intensity and super high-intensity ("Hitex," National Carbon Co.) positives are used instead of the 14 mm size. The difference in current requirements and burning characteristics is negligible. Also, the sizes of the negative carbons in these trims are usually given in fractions of an inch in America.

to more than 20% or less than 10%, however.

The angle of light-pickup may be increased by either increasing the diameter of the collecting element or moving the arc closer to the collecting element. Both expedients are limited in usefulness by practical considerations.

Light Increase Expedients

In the first case, an oversize collector increases the "spread" of the light rays passing through the aperture. As a result, many of the rays which pass through the aperture may miss the lens entirely, passing to one side of the lens barrel. Since it is the rays passing near the edges of the aperture which are apt to miss the projection lens, the effect of an oversize collector is to increase the brightness of only the middle of the projected picture.

Moving the arc closer to the collecting element necessitates a greater curvature of the mirror or condensing lenses to prevent out-of-focus effects which discolor the light, or else an increase in the distance between lamp and aperture with smaller collector corrections. But this expedient increases the size of the spot (image of the arc crater), wasting light on the cooling plate.

There exists a "happy medium" where maximum efficiency is obtained, hence the optical specifications of most projection lamps cannot be altered without seriously impairing performance.

Although simple in theory, the optical functioning of any projection arclamp is considerably complicated by the fact that the "object" (luminous positive crater) and the "image" (the "spot") must be aligned with the aperture and lens of the projector as well as with the optical components of the lamp itself. In other words, the exact centers of (1) mirror (2) positive crater (3) condensing lenses, if any; (4) projector aperture, and (5) projection lens must all lie on the *optical axis* of the projection system.

Optical Element Displacement

The optical axis of a motion picture projector is determined by the positions of aperture and lens of the projector head, *not* by the lamp. The axis is a *straight line* which passes through the exact centers of lens and aperture. Extended forward, the optical axis hits the center of the screen when the projection is level, or a point slightly above the center of the screen when there is a downward projection tilt. Extended backward, it should pass through the exact centers of the condensing lenses (if any), positive crater, and reflector.

It is astonishing how much light is lost when the crater and lamp optical elements are displaced by even a small fraction of an inch from their correct positions on the optical axis. Not even the most meticulous adjustment of the mirror-focusing knobs can restore light which is lost when the mirror, the arc, or the whole lamp is shifted off the axis or positioned askew on the pedestal lamp-table. Restoration of the alignment has often doubled, and in many cases tripled, the light on the screen.

The screens of many theatres are being literally robbed of light by maladjustment and misalignment of the projection lamps. In most instances the projectionists have become so accustomed to the poor light that they accept it as normal. The lamps have "been that way" for more years than anyone can remember; and nobody has bothered to check them and line them up properly.

Lamp Alignment Procedure

Detailed instructions for adjusting the positions of lamp elements may be obtained from the manufacturer. These instructions should be carefully followed whenever it is necessary to realign a carbon guide, raise or lower a positive jaw, or move a mirror bracket sidewise. Aligning tools for certain makes and models of arclamps may be purchased or borrowed from equipment dealers, or the projectionist may make his own.

The first step in lining up a lamp is to establish the correct mirror—aperture distance. This distance, measured

(Continued on page 34)

TABLE E. — CRATER C/P OF SPECIAL HEAT-CONDUCTIVE POSITIVES KNOWN AS "HIGH-BRIGHTNESS" CARBONS. EXCEPT FOR SPECIAL SITUATIONS, USE OF THESE CARBONS AT HIGHER CURRENTS IS GENERALLY IMPRACTICAL BECAUSE OF EXTREMELY RAPID CONSUMPTION AND HIGH COST OF OPERATION.

UNCOATED TRIM Pos. Neg.	ARC AMPS.	ARC VOLTS	UNCOOLED CRATER C/P	COOLED CRATER C/P
9 mm -- 8 mm	150	75	100,000	80,000
9 mm -- 8	230	80	(Overloaded)	120,000
10 mm -- 8	165	80	110,000	85,000
10 mm -- 8	255	80	(Overloaded)	140,000
11 mm -- 8	195	80	120,000	95,000
11 mm -- 8	300	80	(Overloaded)	150,000
14 mm*-- 9	265	80	100,000	70,000
14 mm*-- 9	290	80	(Overload limit)	120,000
14 mm*-- 9	350	80	(Overloaded)	190,000
14 mm*-- 9	450	85	(Overloaded)	210,000
14 mm*-- 9	500	85	(Overloaded)	220,000
16 mm - 10	500	90	(Overloaded)	200,000

*This carbon closely resembles 13.6-mm "Ultrex" positive manufactured and exhaustively studied by the National Carbon Co. In testing this "Ultrex" carbon with water cooled jaws, it was burned with a 5/16 inch (approx. 8 mm) negative at all currents up to 500 amperes.

In The

SPOTLIGHT

PRACTICALLY every organized craft has its detractors, the majority of whom are the employing interests, and certainly the projectionist craft has taken its share of brickbats through the years. One of the more common epithets hurled at the craft has been their designation as "button-pushers," which term is hardly apropos in the face of the craft job done with the various new presentation processes.

Our close contacts with other crafts for many years has taught us that no group of workers gives so unstintingly of their time and money as do projectionists—often at midnight meetings—to the end that they may keep abreast of developments and thus deliver a better job.

Turning our thoughts in this direction was word of a series of lecture-demonstrations sponsored recently by IA Local 150, Los Angeles. Arranged by Business Representative Clyde W. Shuey, the lectures, under the "Carbon Arc Operation" heading, were given on three successive dates—February 2, 3, and 4—by Charley Handley, West Coast representative for National Carbon Co.

Local 150 members were notified by mail of the lectures and were asked to designate the date for their attendance, which was definitely not mandatory. The meeting room which seats 100-plus was on a standing-room-only basis on the first day, and well filled on successive days. In each case the discussion period lasted much longer than the lecture.

IP has long "sold" the idea of such gatherings and, in fact, has made the arrangements for scores of them. Congratulations, Local 150.

• Friendly labor-management relations received a boost recently at the farewell dinner the members of Local 324, Albany, N. Y. gave in honor of Charles A. Smakwitz, former zone manager for Stanley-Warner Theatres in Albany, upon his transfer to Newark, N. J. The Local presented Smakwitz with a traveling bag as a token of appreciation for his fair dealings during his tenure as zone manager in Albany—from 1926 to 1954.

In Memoriam
HARRY SHERMAN
March 3, 1952

• The recent mid-winter meeting of the IA executive board in Hamilton, Ont., was preceded by a banquet at the Connaught Hotel tendered by Hamilton Local 303 in honor of IP President Walsh and the members of the board. About 200 guests and their wives, including prominent civic leaders, were present. Toastmaster Fred Baldassari, member of the Hamilton Local, introduced the speakers, among whom were James Stowe, president of the Hamilton Trades and Labor Council, and Hugh J. Sedg-

IA President Walsh is shown here wearing one of a set of Hudson Bay blankets presented to him by A. L. (Pat) Travers, business representative of Toronto Local 173, at the recent dinner given in honor of Walsh and the members of the IA executive board. Looking on approvingly are Bert Higgins, recording secretary; James Sturgess, president, and Lou Lodge, Jr., secretary-treasurer, members of Local 173.

IA President Walsh poses with officials of Local 303, Hamilton, Ont., at the welcoming banquet Local tendered the IA executive board members during the recent mid-winter meeting. Seated, left to right: Hugh Sedgwick, 5th IA vice-president; Walsh; H. H. Thornberry, president, and H. W. Usher, business representative. Back row, left to right: H. Konkle, member, executive board; S. James, vice-president; J. P. Owens, treasurer and A. Loughlan, member, executive board. Extreme right, unidentified member of Local 303.

wick, 5th IA vice-president (Canada).

Toronto Local 173 was host to the executive party at the close of the sessions at a dinner-dance held in the Indigo Room of the Barclay Hotel in Toronto. A highlight of the party was the presentation to President Walsh of a set of Hudson Bay blankets. Among the speakers at the Toronto party were Allister MacArthur, president of the Ontario Provincial Federation of Labor, and William Genoves,

Projectionists Local 348, Vancouver, B. C., donated a motion picture camera to the Children's Hospital in Vancouver, which will be used to take motion pictures of the patients at various stages of treatment, thereby helping the doctors check on their progress. Local 348 members, W. A. McCartney (center) and F. M. Smith demonstrate the camera with patient Johnny Smith as the subject.

president of the Toronto and District Trades and Labor Council. James Sturgess, president of Local 173, was the toastmaster.

• The long drawn-out negotiations between Local 302, Calgary, Ont., and Famous Players and Odeon Theatres were finally settled and new contracts were signed giving the projectionists an increase of 42c per hour, from $2.58 to $3.00 on a 33-hour work week. Hugh J. Sedgwick, IA 5th vice-president, assisted Local 302 in the settlement.

• We were sorry to learn that Joe Leavitt, charter member of Cleveland Local 160, has been hospitalized for the past several weeks. We wish him a speedy recovery.

• IA President Richard F. Walsh will receive the second annual Heart Award at the forthcoming dinner of the Variety Club of New York, Tent No. 35, which will be held at the Waldorf-Astoria Hotel on May 2. The announcement was made early this month by Edward Fabian and William German, officers of the Variety Club.

• At dinner with Lester Isaac, director of exhibition for Cinerama, the other evening the talk turned to the magnificent job done by the craft at large in putting over the various new projection processes. Lester, formerly director of projection and sound for Loew's, Inc., while lavish in his praise of current projectionist effort, said that we shouldn't forget the terrific contributions made by the veterans in the business.

This verbal tack brought us around, naturally, to the superb work done for the craft over the years by one who was not even a projectionist—P. A. "Better Projection Pays" McGuire. The many honors heaped on "Mac" by the organized craft would require a long list indeed, but we're always happy to salute "Mac," now in retirement at his home in Amityville, Long Island, N. Y.

• Among the IA men inducted in the Famous Players 25 Year Club at the company's recent dinner party in Toronto were the following: Victor Baldassari, Hamilton Local 303; Ed L. Dale, Windsor Local 580; Robert Manson and Arthur Milligan, Toronto Local 173; Edgar Osborne, Halifax Local 680; Mike Freeman, Peterboro Local 432; Albert Foster and Frederick Simmons, Vancouver Local 348.

• Under the terms of a two-year contract with the independents, members of Pittsburgh Local 171 will receive two weeks vacation with pay, plus an hourly wage increase of 5c for the first year and an additional 5c per hour for the second year.

Lester Matlock (right), member for the past 40 years of Local 294, Phoenix, Ariz., was presented with a gold life membership card in recognition of loyal and outstanding service to the local. Matlock served the Local down through the years in various official capacities. The presentation was made at the January meeting by Don J. Fisk, treasurer of the Local and lifelong friend of Matlock. Local 294 members turned out en masse to do honor to their brother member.

Trans-Lux Ends Rear Projection

The Trans-Lux theatre chain, which for many years was unique in that it employed rear-projection, is now converting to standard front projection for the installation of CinemaScope. It is estimated that the conversion job will cost $30,000 per theatre.

Shown here are re-elected officials of Local 384 , Hudson Co., N. J., at the recent installation ceremonies, left to right: Ralph De Meo, business representative; Richard Hancox, member of Jersey City Local 59 and installation officer; Frank Mondrake, president, and Albert De Titta, vice-president, Local 384.

The Development of the Motion Picture Projector

By THOMAS ARMAT

Nine out of ten projectionists, if asked who "invented" or developed the motion picture projector, likely would reply: "Thomas A. Edison." But he didn't; nor did he believe it possible to develop such a mechanism until he actually witnessed a demonstration. This and many other interesting points are included in the appended contribution by T. Armat, to whom is due the major share of credit for the development of a projector the basic features of which remain unchanged to this day. The Historical Committee of the SMPTE deserves credit for this absorbingly interesting contribution to the literature of the art.—EDITOR.

IT is difficult to trace to its beginning and fix a date for the conception of and idea that leads to an invention. Of the interesting impressions of my childhood, the one made by the toy known as the Zoetrope was among the most outstanding. The idea that its principles might be applied to producing a series of consecutive instantaneous photographs of objects in motion, so as to reproduce the motion, was suggested by something I had read, and the fascinating thought persisted in my mind until the Anschutz tachyscope I saw at the Chicago World's Fair in 1893 brought a realization of its actual accomplishment.

In the summer of 1894 I saw at Washington the first exhibition there of the Edison kinetoscope. It interested me greatly. About that time Mr. H. A. Tabb . . . endeavored to interest me in a business way in the kinetoscope. He gave me glowing accounts of the public interest in kinetoscope exhibitions and of the profits to be made therefrom.

After investigating the matter I told Mr. Tabb that I could not see anything very promising project, but scope as a commercial project, but that I could see a lot in a machine of the kinetoscope type if the pictures could be projected upon a screen, and that I believed that I could devise such a machine.

Liason With Jenkins

Mr. Tabb's answer to that was that he did not believe it was possible to project such pictures successfully, because . . . the Edison Company . . . had failed to do so, and he, therefore, did not believe it could be done. From what I knew of stereopticons it did not seem to me that the problem presented insuperable difficulties, and I began a research to find out all I could as to the state of the art and what, if anything, had been accomplished in the way of projecting such pictures upon a screen, at the same time starting preparations for experimental work.

In the Fall of 1894 I enrolled as a student in the Bliss School of Electricity of Washington, D. C., largely for the purpose of acquiring practical information as to handling an arc light that I proposed to use in my motion picture projection experiments. When I explained my purpose to Professor Bliss, he told me that there was another student in his school who was also interested in motion picture experiments. A few days later, at one of the classes, Professor Bliss introduced to me C. F. Jenkins, the student in question. Jenkins was a stenographer in the Life Saving Service, a branch of the U. S. Treasury Department.

Vital Shutter Modifications

It developed that Jenkins, with the cooperation and assistance of Professor Bliss and E. F. Murphy, the latter having charge of the Edison kinetoscope in the Columbia Phonograph parlors in Washington, had assembled a modification of the Edison kinetoscope, in which all Edison parts, films, sprockets, etc., were used. Jenkins called this peephole machine a "Phantoscope," and applied for a patent on it November 24, 1894. The patent was issued as No. 536,539 on March 26, 1895.

As the patent shows, the Jenkins modification differed from the kinetoscope only in respect to the shutter. Instead of using a rotating shutter with a slit in it for exposing the continuously running film over a stationary electric light bulb, Jenkins rotated the bulb itself. This modification accomplished no improvement in results. It amounted to a somewhat different way of doing the same thing in a somewhat less efficient manner. Its only virtue consisted in the possible avoidance of certain claims in the Edison kinetoscope patent, in which a specifically described shutter was included as an element. These claims were cited by the Patent Office against the Jenkins application.

Practically every night that we met at the Bliss School, Jenkins urged me to join with him in experimental work to develop a motion picture projection machine. He was fully convinced that a successful projection machine could be built upon the principle of the continuously running film of the Edison kinetoscope type of exhibiting machine. I was not so certain about that, but I felt that an experimental start had to be made and the sooner the better, and finally agreed on March 25, 1895, to join with Jenkins under an agreement which he prepared. In April or May of 1895 we completed a projection machine built on the kinetoscope principle. The machine turned out to be a complete failure, for reasons now obvious to anyone familiar with motion picture projection problems.

40-per-Second Rate

After that I took complete charge of further experimentation, at my own expense, and finally we produced the first projection machine ever made that embodied an intermittent movement with a long period of rest and illumination of the pictures on the film. Application for patent on this machine was filed on August 28, 1895, and later issued to Jenkins and Armat as patent No. 586,953.

The Edison films we used (the only kind obtainable then) were all taken

(Continued on page 31)

There is only one

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CinemaScope, Wide Screen Lens Calculations

By JOSEPH F. HOLT
Member IA Local 428,
Stockton, California

IN BOTH circuit and independent theatres the projectionist is frequently called upon to specify lens and aperture sizes for various aspect ratios. This requires an approach to the problem from a mathematical viewpoint; but frequently projectionists are unsure of the method to be followed. The writer, therefore, has set down in rule form some simplified procedures which will yield reliable results.

A common occurrence is when a representative of management enters the projection room and announces: "We are going CinemaScope and wide-screen in a couple of weeks. What lenses and apertures shall we order?" This is all too frequently met with an evasive reply which does not add to the confidence which management should have in projectionists.

Data Book a Prime Requisite

The first requirement for any well-run projection room is a data book recording all figures relating to the theatre. What is the aperture to screen distance? What is the proscenium opening? All figures known to be accurate should be kept in such a book, thus making possible speedy and accurate answers when problems of lens and aperture size arise.

Let us assume that we have such a data book, and that we have just been asked such a question as previously posed. We are now in a position to ask a couple of questions of our own. What is the desired CinemaScope aspect ratio? and what wide-screen height and ratio is preferred?

Frequently, management will rely upon the projectionists to answer these last two questions. At this point each man is on his own. In the writer's opinion, most theatres would do well to settle upon a 2.33 to 1 CinemaScope aspect, and a ratio for wide screen dependent upon the type of product used by the theatre.

Consider Type of Product

For instance, if cartoon shows are run often, or older product and reissues are used, a 1.66 to 1 ratio is advisable. Many theatres have adopted a uniform 1.75 to 1 ratio for all product except CinemaScope or Superscope; and it is well-known by now that the VistaVision release prints are composed for a 1.85 to 1 ratio. It is obvious, therefore, that we have a number of possible choices and that certain considerations enter into the final selection.

Take a look at the house which runs only current product and uses a news and cartoon as usual short product. A 1.75 to 1 ratio is sensible here; but 1.85 to 1 is possible in order to obtain uniform picture size when VistaVision prints are screened. Now, this is the type house with which we are concerned. Upon our recommendation, it is decided that 2.33 to 1 for CinemaScope, and 1.85 to 1 for wide screen will be adopted.

Our data book tells us that "throw" distance is 125 feet, and that the proscenium opening is 25 by 45 feet. Let's settle on 42 feet for the width, and since we selected 2.33 to 1, we divide 42 by 2.33 and obtain a CinemaScope height of just a bit over 18 feet. Fine, we say, 18 by 42 feet is a nice screen image size. Now what projection lens focal length is needed?

Figuring Conversion Process

The full aperture height of CinemaScope is 0.715 inch as compared with 0.620 for the old proportional aperture. Now we use the rules which we are developing here. Convert the "throw" distance to number of inches by multiplying by 12. In this case, a distance of 125 feet results in 1500 inches. We then multiply the "throw" distance in inches (1500) by the aperture size in inches (0.715) and obtain a product of 1072. We convert the desired picture height in feet to inches by multiplying by 12 — thus 18 feet by 12 gives us 216.

We divide the product of "throw" times aperture height (1072) by picture height (216), and obtain a quotient of 4.97, which is the focal length of lens needed. Let's ask for a 2.33 to 1 CinemaScope aperture and a 5-inch lens. Now, just a word about CinemaScope aperature dimensions.

Undersize apertures are available, such as 0.650 by 0.650 inch which provide any ratio to fit from 2 to 1 on up to 2.55 to 1, the full CinemaScope ratio. The writer has filed apertures up to dimensions of 0.695 inch which have the advantage of masking off editor's splice lines which in some product show up as brilliant white lines at the point of each editor's splice in the master.

In the present case, if we decide to mask down to 0.695 inch, we will ask for a 4.75-inch lens, knowing that we will come out with a height of 22 feet. If we have a screen 22 x 44 feet, all is well. But we have dropped our aspect ratio to 2 to 1 from the 2.33 to 1 we originally planned, and we will do well to stick with the 5-inch lens and a 2.33 aspect ratio.

The next set of rules is based upon ratios and is used as follows: we have selected a 5-inch lens for CinemaScope, and have decided to go to 1.85 to 1 for other product. The vertical dimensions of various aspect ratio apertures are as follows: 1.66 to 1 measures 0.497 inch; 1.75 to 1 comes to 0.471 inch; and the 1.85 to 1 dimension is 0.446 inch, and this latter we are using this time.

We do this: taking the aperture vertical dimension of 0.446 inch, we multiply by the focal length of the CinemaScope lens (5-inch) obtaining a product of 2.23. We divide this product by the CinemaScope aperture vertical measurement (0.715 inch) with a result of 3.12.

Sound Judgement Needed

This is where good judgment comes in, because if we order a 3-inch lens, we will have overlap on the screen masking, resulting in a ratio nearer 2 to 1, which is literally mayhem committed on all non-anamorphic product. So let's go for a 3.25 lens, after we repeat the last procedure, for a 1.75 to 1 aperture with a focal length of 3.29 inches indicated.

Result: we ask for a 2.33 to 1 CinemaScope aperture, a 0.471 by 0.825-inch aperture, a 5-inch lens, and a 3.25-inch lens for each projector we plan to use. Just in case readers wish to check results of their calculations, the writer submits computations for various ratios in the theatre submitted in his paper as an average problem: 1.66 to 1 ratio with aperture of 0.497 by 0.825 inch, a 3.5-inch lens; 1.33 to 1 with old aperture 0.620 by 0.825 inch, a 4.34 calculation, with a 4.25-inch lens and undersize aperture being used.

Ashcraft's New Cinex 170 Arclamp

By CLARENCE ASHCRAFT

THE CINEX 170 is a projection lamp so powerful that its operation in the higher current ranges, for which it was specifically designed, is entirely unnecessary for even the largest present-day drive-ins and indoor theatre screens. This new lamp has enormous reserves—for the inevitable wider films and larger screens of the near future. Only a relatively small portion of the light the Cinex is capable of delivering may be necessary now. In a short time, however, new processes may make the use of more light essential, when the reserve power of the Cinex will come into play.

Now is the time for a complete departure from previous ideas of lamp design. In order to have a long useful life, a lamp must be capable of accommodating not only most of the present carbon trims but also all new carbon sizes which might come out in the foreseeable future. High efficiency must be coupled with maximum operating economy.

Extreme Operating Versatility

The Cinex 170 may be operated with practically every size of high-intensity carbon now available or being considered, and can deliver to the screen the highest amount of light produced by these carbons. This lamp is capable of conforming with the following carbons and their operating loads:

9mm Standard High-Intensity Carbon .....at 80-90 amps.
10mm Standard High-Intensity Carbon .....at 90-105 amps.
10mm Special Carbon .....at 125-135 amps.
11mm Standard High-Intensity Carbon .....at 115-128 amps.
11mm Special Carbon (Future) .....at 150-160 amps.
13.6mm Standard High-Intensity Carbon .....at 140-170 amps.

The Cinex 170's are equipped with 18-inch reflectors, and when correctly aligned with a projector this lamp optical system provides a speed of F:1.64. This lamp will operate at its maximum efficiency when used with the new F:1.7 lenses, but even with the older slow-speed lenses, it will give greatly improved results.

Tests have shown the following results in light production:

With 10-mm H-I (or equivalent) carbon trim at 95-100 amperes — 34,000 lumens for CinemaScope aperture; 26,000 lumens (low range) for standard aperture.

With 11-mm H-I (or equivalent) trim at 125-130 amperes—36,000 lumens for CinemaScope aperture; 27,500 (normal range) for standard. (Use of 11-mm trim in other type lamps at 120-125 amperes produces approximately 21,500 lumens with standard aperture.)

With 10-mm "Hitex" (or equivalent) positive carbon at 135 amperes —36,000 lumens for CinemaScope aperture; 27,500 (normal range) for standard.

With 13.2-mm H-I trim at 160 amperes—41,500 lumens for CinemaScope aperture; 32,000 (high range) for standard aperture.

Additional Cooling Aids

In order to follow standard, comparable measuring procedure, these light readings were made with a 3.5-inch focus, F:1.7 lens, without shutters and without heat filters. However, for actual theatre operation it is definitely recommended that heat filters be used. The Cinex 170 is provided with the best available dichoric heat-reflector filters. It is further recommended that projectors be equipped with aperture gate air jets and, possibly, with gate water-cooling devices.

The Cinex 170 design is such as to realize maximum light output from the high collecting value of its 18-inch mirror. *Care must be taken so that projector housings and shutter frames will not interfere with the maximum passage of light.*

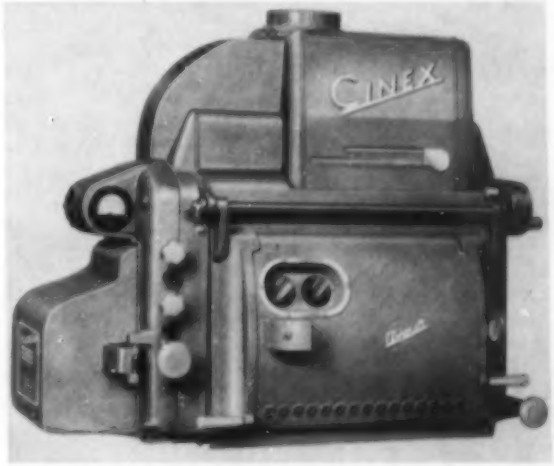
It may be seen from the test results that the Cinex 170 under optimum conditions will generate from 26,000 to 32,000 lumens through a standard 0.825 by 0.600 film aperture and from 34,000 to 41,000 lumens through a full 0.912 by 0.715 CinemaScope aperture. These are the highest values yet attained by any production type commercial arclamp which has come to our attention.

Despite its simplicity of design, the Cinex 170 lamphouse basic ruggedness guarantees very slight wear and tear of all parts, promising a long and economical operating life. The two solid silver contact jaws, both water-cooled, are practically indestructible. These jaws are located only ¾ inch behind the carbon crater, but they are so cool that they can be grasped by the human hand immediately after a 13.6-mm arc operating at 180 amperes is broken, indicating almost complete heat transfer.

Air-Circulating System

The Cinex 170 features a new air-circulating system. The lamphouse blower system takes cold air from outside the lamp and directs it in a carefully-designed pattern over the filter, through the hollow walls and ducts, across the reflector, and ejects it into the projection room exhaust stack.

This air-conditioning system keeps all parts of the lamphouse extremely cool, eliminates overheating of the reflector, steadies the operation of the arc flame, and makes the lamphouse



The new Ashcraft Cinex 170 projection arclamp is designed to permit an extremely wide range of carbon-trim selection, great flexibility and an overall cooling system which meets the needs of both indoor and outdoor theatres.

practically independent of the variable drafts from the projection room exhaust system.

The air which sweeps across the reflector keeps it cool, prevents undesired strains and stresses in the glass, prevents cracking and maintains the glass surface free of pit, soot and ash deposits. This method of air conditioning was used in the Ashcraft Air-Blast lamp (1927). Even after 20 minutes of operation at 180 amperes, the Cinex reflector may be touched and handled without any harmful consequences.

New Projection Vistas

The amount of light which can be produced with this new lamp may open up some new procedures in projection. Even allowing for heat filter, shutter and lens losses, it is possible to project CinemaScope pictures up to 80 feet in width and still maintain a brilliancy of 10 foot-lamberts at the center of the screen. With this amount of light, it may be possible to use white matte screens in order to improve the reflected light distribution pattern in the orchestra and balconies of large theatres.

For drive-in theatres, where 4 foot-lamberts seems to be the normal required brilliancy, these lamps assure well-lighted CinemaScope pictures having a width of 130 feet or more.

Todd AO Six-Track Sound

The Todd-AO company has definitely decided to use six-track magnetic stereophonic sound for its road showings Before the decision was made, both seven-track and four-track sound were considered.

Toll-Tv Row Spiced By FCC 24 Questions

NEXT month the film industry may get some ideas of what attitude the government will take anent the muddled and highly controversial plans to charge home Tv owners for some programs. The FCC will hear arguments for and against the toll-Tv idea and will, presumably, schedule formal hearings or act in some other way soon thereafter.

A committee of prominent exhibitors has declared itself absolutely opposed to toll Tv, claiming that it will destroy the motion picture theatre which provides paid-for entertainment without trespassing on the freedom of the air. Heretofore, the air waves have been regarded as public property, even though the radio and Tv interests have reaped lush profits therefrom for many years.

Three Competing Systems

There are at present three systems of toll or subscription Tv. Two of these, Phonevision, sponsored by Zenith Radio Corp., and Skiatron, sponsored by Tv film producer Matthew Fox, have applied to the FCC for commercial authorization. The third system, Telemeter, 80% owned by Paramount Pictures, has conducted tests in Palm Springs, Calif., during the past year, but it has not yet filed application with the FCC. Details of the three systems follow:

Phonevision, oldest of the three, was originally a system whereby an extra "unscrambling" signal was sent over telephone lines to the home. Zenith Corp. now has other methods in mind, including transmission of a coded signal which is decoded by means of a special device attached to the Tv set.

The Skiatron system envolves "scrambling" of the image at the transmitter. The jittery image steadies when a thin decoder card is inserted into a unit at the receiver. In both the Skiatron and Zenith systems, the code for unscrambling the picture can be varied at will to prevent evasion of the fee.

The Electronic Coin-Box

The Telemeter system is an actual coin-box method of collecting fees. An electronic coin-box attached to the receiver shows the type of program being offered and its price. Some improvements have been made in the coin-box system of late, one being that it can now offer "credit" to a customer so that he need not feed the box the exact amount required for a particular program.

The petition filed by Skiatron requests that toll-Tv be limited during the first three years to UHF (ultra-high frequency) channels for a maximum of 35 hours a week.

There is very little agreement among the groups sponsoring toll-Tv. Telemeter-Paramount did not join its two competitors in petitioning the FCC because they do not feel that the decoding gadgets used by the other firms are practical. Also, they feel that Tv stations should not be the only group to participate in the operation of toll-Tv.

Widely Divergent Opinions

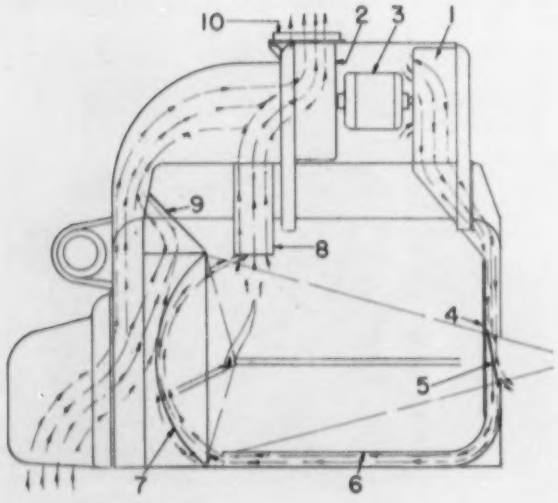
Telemeter holds that film exhibitors should be given the opportunity to participate because they've been selling entertainment; also, that franchise holders should include publishing and cultural interests and the broadcasters themselves.

In its Palm Springs test, the Telemeter system was operated from a local theatre, which fed a first-run film into home Tv sets over a closed circuit. The exhibitor showed this film in his theatre at the same time, promoting customers for both the theatre and toll-Tv.

There is also disagreement among Tv broadcasters concerning the merits of toll-Tv. David Sarnoff, head of RCA, which owns National Broadcasting Co., has repeatedly declared that he sees no future in trying to charge people for home Tv programs.

Many sponsors feel, however, that the cost of producing high-quality shows is so great that advertisers can no longer bear it alone. Also, that the added cost of producing color Tv shows is so great that traditional commercial-sponsor financing will not work.

Among the more than two dozen



AIR CIRCULATING SYSTEM FOR THE CINEX 170

Legend: 1—air injection blower; 2 — exhaust blower; 3—A.C. ball bearing motor; 4—removable front panel; 5—dichroic heat filter; 6—removable wide base duct; 7—18" reflector; 8—exhaust draft tube; 9—reflector air duct; 10—exhaust stack.

questions asked the petitioners by the FCC was one "disclosing the role to be played by the motion picture industry in subscription Tv." Other questions posed:

LAW: Whether the FCC has authority to authorize and regulate subscription Tv; whether the latter constitutes "broadcasting" under the Communications Act, or whether it is a common carrier or other type of service, and whether the FCC has authority to permit it to use channels assigned to Tv broadcasting; if the FCC does not have authority to authorize and regulate subscription Tv, what amendments to the act would be required to permit it.

Technical Data Sought

FACT: Technical data relating to the operation of proposed subscription Tv systems; possibility of degradation and interference with regular Tv service, and any adverse effect on Tv receivers now in the hands of the public; cost of equipment, including necessary modification of existing transmitters and receivers; cost to the viewing audience; means, methods and organizations intending to engage in toll Tv operations.

PUBLIC INTEREST: Whether subscription Tv will "generally encourage the larger and more effective use of radio in the public interest"; its impact on advertiser-sponsor broadcasting; its effect on broadcast of news and diverse views on controversial issues, and safeguards to insure that such broadcasting will continue to be available to the public without charge; safeguards to insure that the public will continue to receive well-balanced Tv programming without charge; safeguards to prevent monolopy.

Eastman Net Profit Soars

Consolidated net sales by Eastman Kodak Co. for 1954 amounted to $633,457,838, missing by only $200,000 the record sales year of 1953. Earnings before taxes were $144,968,534, an increase of 9% over 1953, while net earnings of $69,821,719 after taxes amounted to $3.99 per share compared with $2.86 per share in 1953.

GPE 1954 Profits Up Sharply

Net profit after taxes of $5,488,089 for 1954 is reported by General Precision Equipment Corp., parent company of International Projector Corp., Strong Electric Corp., Hertner Electric Co., J. E. McAuley, National Theatre Supply, and others. This compares with a profit of $3,436,349 for the previous year. Net sales for 1954 amounted to $123,322,634, compared with $87,763,925 in 1953.

Paramount's Biggest Earnings

Consolidated net earnings of Paramount Pictures Corp. for 1954 were the best in the company's history, being estimated at $9,003,000. This is nearly 50% higher than earnings for 1953, which were $6,779,563. Profits in 1954 included $832,000 from the sale and adjustment of investments in subsidiary and affiliated companies.

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LETTERS TO THE EDITOR

Variable Focus Lenses

To the Editor of IP:

I have read your magazine for many years and find it very helpful in keeping up with the latest happenings

There are some things I'd like to ask about: first, I'd like to see an article by Robert Mitchell on the variable focus lenses. To me they seem the ideal lens to give a variety of screen aspect ratios. A short article last year on this subject (I believe it was by Merle Chamberlin) was good, but I'd like to have Mr. Mitchell's opinion.

ALFRED G. QUINN
Local 299, Winnipeg, Manitoba, Canada

EDITOR'S REPLY: Mr. Mitchell also enjoyed Merle Chamberlin's well-informed descriptive articles on variable-focus lens attachments. Since the appearance of Mr. Chamberlin's article (IP for October 1953, page 25), these useful attachments have been placed on the market. These are *supplementary* lenses, meaning that they must be used with the regular projection lenses.

Variable-focus attachments effectively *shorten* the focal lengths of the regular projection lenses to which they are attached; and the desired focal length or picture size is produced by sliding a knob at the side of the variable-focus lens tube.

As an illustration, the Wollensak Vari-Focus attachment gives any desired focal length from 4 inches down to 3 inches when put in front of a 5-inch projection lens. Other ranges of focal length are obtained by using the attachment with regular lenses of shorter or longer focus. The Pacific Optical variable-focus lens works the same way.

Practical Application

Mr. Mitchell's opinion is that variable-focus lenses are mighty handy things to have when several different aspect ratios are used. They spare the projectionist the trouble of changing lenses several times during the show. And there are other advantages, such as the elimination of masking troubles. The mere touch of a finger makes the picture exactly the right size for the screen being used.

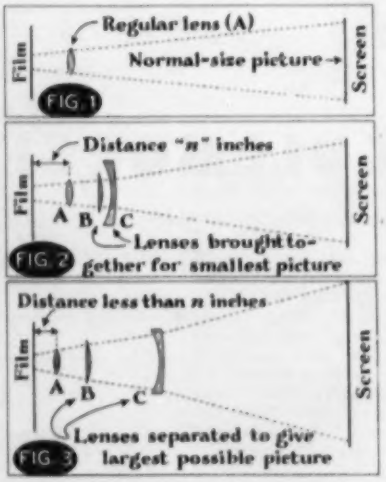
"Imaginative projectionists," said Mr. Mitchell, "can produce a 'zoom effect with variable-focus lenses which provides a novel transition from one film subject to the next when the aspect ratio is to be changed during the show. It is only necessary to slide the lens-knob to increase or diminish the size of the picture before the eyes of the audience."

Many optical designers believe that a lens functions best at just one fixed focal length. Theoretically, these designers are correct, Mitchell assures us. The very highest resolving power and most desirable field characteristics are found only in *fixed-focus* lenses. But, he continued, the available variable-focus attachments give very sharp images at a minimum loss of light when used in conjunction with regular projection lenses of the best quality. They also minimize certain objectionable features of conventional short-focus lenses, such as small depth of focus. These attachments accordingly "hide" film flutter and focus drift.

Optical Principle Illustrated

The optical principle of variable-focus attachments may be demonstrated by means of simple lenses, as shown in the accompanying three sketches (Figs 1, 2 and 3).

In these diagrams the regular "fixed-focus" projection lens is represented by a simple positive lens (A), while lenses B and C represent the two optical elements of the variable-focus attachment. It is the front element of the attachment—lens C—which is moved by the sliding knob to alter the size of the projected picture.



Lens B of the attachment is positive (convex), while lens C, the movable element, is negative (concave on one side). The combination of B plus C is *weakly positive*, hence the longest focal length obtainable with the attachment is slightly shorter than the E. F. of the regular lens.

Now, when C is positioned as close as possible to B, the projected picture is only slightly larger than the picture obtained with the regular lens. (That is, the resultant focal length is only a trifle shorter than the focal length of the fixed-focus lens.)

Focal Length Shortened

But when C is moved away from B, the regular fixed-focus lens must be moved *just a little nearer the film* to get a clear picture on the screen. Moving the regular lens nearer to the film causes the rays of light to diverge—to "spread out"—a little more.

Since the refractive power of lens C remains the same no matter where it is positioned, the spreading of the rays continues all down the line right to the screen itself. The result is a bigger picture. (In other words, the resultant focal length has been greatly shortened by moving C away from B.)

Mr. Mitchell hopes that Mr. Quinn will get a chance to use the new variable-focus attachments and see for himself how nice they are.

Perspecta Sound Data

To the Editor of IP:

It is with much interest that I read articles in IP concerning new technical developments in the motion picture theatre.

With reference to your article by Mark Stevens on Perspecta Sound, I believe that a system such as this could be very well adapted to the reproduction of the full audio spectrum. As you know, some form of attenuation is employed either in the sound track or in the amplifier characteristic to enhance or favor the voice frequencies. Should a relay be actuated by a carrier frequency in Perspecta Sound, we could employ the full sound spectrum from the lowest to highest frequency for musical sections or a show by simply removing the feedback or attenuation from the circuit.

The writer has been accomplishing

this result by manual switch with excellent response in full flowing music at even low volume with no discernable loss at any frequency.

With regard to many of the problems now facing the exhibitor, it is indeed unfortunate that the important decisions in technical matters are not left to a committee of competent engineers, rather than studio heads, for a meeting of minds.

F. Russ
Park Theatre, St. Petersburg, Fla.

EDITOR'S REPLY: Perspecta Sound provides the same frequency response as regular high-fidelity optical sound, reproducing the full audio spectrum from the lowest tone (about 60 cycles per second) to the highest (about 10,000 cycles).

Fundamentals, Overtones

This complete range of frequencies is well balanced, and no special band is favored over any of the others. The *fundamental* range of voice frequencies is from 100 to 300 cycles, while the voice overtones necessary for the intelligibility of speech go all the way from 200 to 6000 cycles, which includes the greater part of the complete audio spectrum.

In certain types of wireless telephony, the voice harmonics in the 300-to-4000 cycle range are overemphasized in order to increase intelligibility; but this favoring of special frequencies destroys the *naturalness* of the sound, making voices rather harsh and "tinny," even though very distinct. This should not be done when naturalness is desired, as in movie sound.

Feedback Adjustment

Perhaps the attenuation Mr. Russ has in mind is that involved in the tone-balancing degenerative (negative) feedback circuits of the amplifiers. The feedback circuits are alterable to permit either the low or high frequencies to be attenuated, giving the exact kind of frequency response best suited to the acoustics of each individual theatre. The feedback adjustments are best made by the sound service engineer, and once made they need never be changed unless the auditorium is rebuilt, or the amplifiers are taken out to be installed in another theatre having different acoustical properties. Changing the frequency-response characteristics of a sound system may upset a delicate acoustical

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balance and destroy the naturalness of the sound.

Another type of attenuation familiar to projectionists is that produced by the "crossover" filter network associated with each speaker assembly consisting of low- and high-frequency units. The purpose of the filter network is to cut off the middle and high frequencies from the low-frequency speaker (called the "woofer"), and to cut off the low frequencies from the high-frequency speaker (the "tweeter").

Frequency Acceptance, Rejection

If a loudspeaker is fed frequencies which it is not designed to handle, it may get "rattled" and distort the sound. The characteristics of the filter networks are fixed, however, being set at the factory to match specific types of speakers.

It is not quite clear to us how Mr. Russ obtains the type of frequency response which he desires in musical reproduction; but at least we can say that we are in complete agreement with his opinion anent technological decisions being made by those best qualified to make them, *i.e.*, competent engineers.

Proper Lens Selection

To the Editor of IP:

As subscribers to IP, we seek your advice regarding backing (objective) lenses for our projectors in order to screen CinemaScope pictures. We operate Super Simplex projectors and have a projection throw of 350 feet. We desire to obtain a picture of approximately 68 by 30 feet.

We have been advised that we will require a 9-inch backing lens, which can be supplied by Kollmorgen Optical Co. (Snaplite Series II) on special order. As this is a slow lens we anticipate a loss of light, quite apart from that occasioned by the anamorphic attachment. However, we can increase our amperage to 165 amps, which will compensate somewhat.

Could you advise whether a 9-inch lens is the correct size for us.? We do not wish to rebuild our screen if we can possibly avoid it.

CHARLES MILLER
Johannesburg, South Africa.

EDITOR'S REPLY:

A 9-inch lens behind the anamorphic attachment will prove satisfactory, but will give a slightly smaller CinemaScope picture than the desired 68 feet by 30 feet at a throw of 350 feet. As a matter of fact, the specified picture-size has an aspect ratio of 2.267/1, which may be regarded either as not quite wide enough or as a bit too high. To get this aspect ratio on the screen, undersized apertures will have to be filed out to the required width.

The regular CinemaScope aspect ratios are 2.55/1 for magnetic-track prints, 2.35/1 for optical-track prints, and an undersize 2/1 ratio for both types of prints.

Assuming that optical-track CinemaScope prints are to be played in this drive-in theatre, and that 0.839 x 0.715 inch apertures (aspect ration 2.35/1) will be used, 9-inch lenses will produce a picture 65.26 x 27.80 feet at a 350-foot throw.

To calculate picture size for CinemaScope, the following formulas, *in which all dimensions and distances are expressed in inches,* are used:

$$\text{Height} = \frac{\text{Aperture Height} \times \text{Throw} \times 2}{\text{E.F. of lens}}$$

$$\text{Width} = \frac{\text{Aperture Width} \times \text{Throw} \times 2}{\text{E.F. of lens}}$$

These formulas may be "juggled" algebraiclally to find the E.F. (equivalent focal length) of lens needed to give a required CinemaScope picture height or width at a specified throw. To get a picture 68 feet wide at a 350-foot throw (optical-track CinemaScope aperture), a lens of 8.63 inches focus is needed. To get a picture 30 feet high at a 350-foot throw (same aperture), a lens of 8.34 inches focus is needed. Suppose, now, a compromise is made by using a lens of 8½ inches focus.

With an 8.5-inch lens (same throw and CinemaScope aperture), the picture will measure 69.09 x 29.44 feet. This is very close to the size specified by Mr. Miller. We therefore recommend 8½-inch lenses on the assumption that the throw has been correctly measured. If there be any doubt on this score, 9-inch lenses, which will give a somewhat smaller picture, should be used.

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PERSONAL NOTES

W. Douglas Matthews has been appointed to the newly-created post of vice-president and general manager of Motiograph, Inc., manufacturer of 35-mm projectors and sound equipment. This appointment is part of an internal reorganization to achieve better supervision and control of the expanding activities of the company, which is soon expected to announce its entrance into the non-theatrical film field with a new product under development.

The former duties of Matthews as treasurer, are being taken over by John J. Bullers, accounting head, who will now function as secretary-treasurer.

M. J. ("Mike") Yahr has been appointed to the newly created post of manager of RCA theatre and sound products, headquartering at Camden,

M. J. ("Mike") Yahr wins RCA promotion.

N. J. Yahr will coordinate planning, promotion and sales activities for a wide range of products, including theatre equipment, visual and sound equipment, the "Tv Eye" and other closed-circuit Tv equipment. He joined RCA in 1929 as a theatre equipment field engineer.

Hollis D. Bradbury has been named Manager for RCA film recording equipment, succeeding Ralph A. Teare, recently advanced to Manager for RCA industrial products. Bradbury, with RCA since 1927, will coordinate all planning promotion and sales activities for film recording equipment and will also supervise the operation of RCA's recording studios in New York and Hollywood.

Paul R. (Pete) Wentworth has been appointed media buyer for Eastman Kodak Co. and will be in charge of market and media selection for Kodak advertising in trade papers, newspapers, general magazines and Tv. Wentworth joined Kodak in 1946 as a supervisor of the sales service division's literature distribution activities. For the past year he has served as assistant manager of the advertising department's package design division.

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Fox Plans to Make 16-mm CinemaScope Prints

After previously stating that it would not release any 16-mm versions of CinemaScope films, 20th Century-Fox is now expected to reverse itself because of the considerable financial loss involved in ignoring this market.

Most producing companies using CinemaScope make 16-mm prints from 35-mm "unsqueezed" negatives that are photographed at the same time the CinemaScope cameras are in action. In this way they are protected against distribution difficulties because they have all types of prints ready for release.

Equipment Problem

20th Century-Fox has a different plan for the 16-mm field. It is now working on the idea of releasing "squeezed" 16-mm CinemaScope prints. This approach would result in an equipment problem because there is no reasonably-priced anamorphic lens unit to use with 16-mm projectors. Bell & Howell did produce a combination taking and projection lens unit for 16-mm anamorphic films, but this lens is considered too expensive. However, Bausch & Lomb, which produces a wide line of CinemaScope lenses for studios and theatres, is said to be designing a 16-mm projection unit that will sell for about $100.

40,000 Projectors Used

A recent survey showed that there are more than 40,000 16-mm projectors being used in the United States and Canada. This figure breaks down into 19,000 in use at schools and colleges, 4,000 in shut-in institutions, 6,000 in towns without theatres, 1,500 Navy projectors, and 1,300 in use by the Army, Veterans Administration, Red Cross and similar organizations. Canada accounts for about 11,000 projectors.

New VV Horizontal Projectors Into N. Y. Paramount

Horizontal film-path projectors will be installed at the New York City Paramount Theatre and will be used first about the middle of April. The special double-size frame projectors are now being installed by the Century Projector Corp. This projector has gone through a complete design and development program at Century since it was first used experimentally at the Radio City Music Hall, N. Y. City, last Fall, but it is not yet known whether this Paramount installation indicates that other Par installations will follow.

Technical details of the improvements in the horizontal projector will be reported in IP as soon as possible.

Example of Closed Circuit Tv

An example of the growing use of this principle can be found in the method used by Dr. Norman Vincent Peale, pastor of the Marble Collegiate Church, N. Y. City and top best-selling writer for 118 weeks, in handling overflow crowds at his church. Closed-circuit Tv pipes his weekly sermons to listeners in several separate auditoriums.

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PROJECTOR DEVELOPMENT

(Continued from page 20)

at the rate of approximately 40 per second. The machine could not run the films at more than half speed, and it thus gave a slow-motion effect to all the scenes. It made a terrific noise. The sprocket and mutilated gear weighed more than a pound, and after a few experimental exhibitions the recesses in the driven gear were battered out of shape and made useless. The machine was never exhibited outside my office at Washington. I still have the original sprocket and mutilated gear.

Under date of August 30, 1895, Jenkins wrote his friend Murphy that the machine was a "grand success," but I regarded it as a complete failure so far as its having any commercial value was concerned, and addressed myself to the task of devising a practicable machine. This I accomplished a short time after the failure of the Jenkins and Armat machine, with a modification of the Demeny camera intermittent negative film movement, adapted to projection machine requirements. I hurriedly assembled a crude machine, tried it out and found it satisfactory. Immediately afterward I had a more substantial machine made, and with it gave a number of successful exhibitions in my office to friends and acquaintances. An account of this machine was published in the *Baltimore Sun* of October 3, 1895.

First Public Showings

In September, 1895, we took this machine to the Cotton States Exposition at Atlanta, Georgia. Subsequently I had two duplicate machines made and sent to us there for exploitation purposes. I obtained a concession from the Exposition authorities and built a theatre in the grounds for giving exhibitions, with the thought that receipts from the theater would help to pay the exploitation expenses. The anticipated Exposition crowds did not materialize, the receipts were

Theatre Tv and Broadcasters Vie for Rights to Fight

Theatre Tv interests and Tv broadcasting networks engaged this past month in a bitter competitive battle for the rights to telecast the forthcoming championship fight between Rocky Marciano and England's challenger, Don Cockell, scheduled for the week of May 16 in San Francisco.

The San Francisco location of the bout presents an intriguing opportunity to theatre Tv program producers because the populous New England and Middle Atlantic areas will not be blacked out for Tv. In this case, the fight promoters would probably permit theatre telecasts of the bout anywhere outside a 50-mile radius of San Francisco.

(P.S. The theatres won.)

OBITUARY

CLARENCE HUBERT (BERT) PERRY, 57, member of Local 634, Sudbury, Ont., Canada, was stricken with a heart attack early this month while working in the projection room of the Capitol Theatre in Sudbury. He was a former member of Toronto Local 173, transferring to Sudbury some years ago. Known in the industry as one of the top-notch projectionists in Canada, Perry's services were very much in demand. About a year ago he was presented with a gold watch by Famous Players Corp. as a member of the company's 25-Year Club. He was very popular in projectionist circles and his sudden death was a shock to his many friends.

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small, and a very considerable loss was incurred.

While at Atlanta, Jenkins borrowed one of the three machines, saying that he would like to take it to Richmond, Indiana, to give some exhibitions to his friends on the occasion of his brother's wedding, and that he would be back in a few days. Jenkins gave an exhibition with this machine in his brother's store in Richmond, as announced in the Richmond *Daily Telegram* of October 30, 1895.*

After Jenkins' departure from Atlanta I made some important improvements in the machine, including a loop, or slack-forming means, that improved the exhibitions and greatly reduced the wearing of the films. Subsequently I remodeled the machine, to give it a more commercial form.

*Editor's Note: It has been stated several times in the literature that C. F. Jenkins gave an exhibition with his projector at Richmond, Indiana, on June 6, 1894, but no proof of this earlier date has been obtained by the Historical Committee. A photographic copy of the Richmond Daily Telegram for Oct. 30, 1895 describing the showing on Oct. 30, 1895, is in the files of the SMPE Historical Committee.

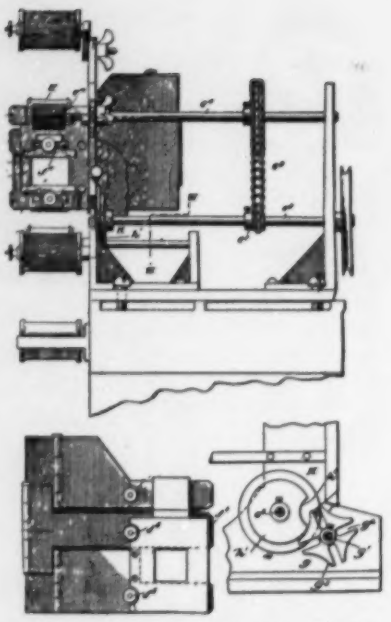
The Raff & Gammon Combine

In December, 1895, I got in touch with Messrs. Raff and Gammon of New York, who were the exclusive agents for the Edison kinetoscope and films. My idea was to arrange for a supply of films. In reply to a letter to them asking that they come to Washington to see my machine, I received an answer to the effect that they had no faith in motion picture projection machines, since they had endeavored to induce the Edison Co. to produce one and they had failed to do so, and they did not believe motion pictures could be successfully projected.

After a further exchange of letters Mr. Gammon agreed to come to Washington if I should pay his expenses, which I agreed to do. Mr. Gammon arrived with a sort of apologetic air of having been fooled into a wild-goose chase. When I took him into the basement of my office and threw a picture upon the screen, his attitude underwent a complete transformation. His excitement and interest were most apparent.

Prototype to Edison

The result of the interview was a contract under the terms of which Raff and Gammon undertook to furnish films and to manufacture a certain limited number of machines,



Drawings from the Armat Vitascope patent No. 578,185, dated March 2, 1879, showing the intermittent movement employing the star-wheel, or Geneva cross.

and licenses were to be granted upon a royalty basis to users of the machines and films, with territorial restrictions. No machines under any circumstances were to be sold. The Edison Co. was to make the machines from a model I was to send them.

Mr. Edison wanted to see an exhibition of the machine before details as to the number of machines to be made by him, the supply of films, *etc.*, were to be decided. It was arranged that I should give Mr. Edison an exhibition. I sent a machine over to the Edison Works at Orange, N. J., and later, Messrs. Raff and Gammon and I went over from New York to give the exhibition. The exhibition took place in a large room in the Edison plant and the sheet was a large one.

Edison Deal Arranged

Mr. Edison was obviously surprised at the excellence of the exhibition and so expressed himself. On the way back to New York Mr. Gammon told me that Mr. Edison had agreed to all our plans but expressed the opinion that we were planning to have more machines made than necessary. We planned to make eighty machines at first, but Mr. Gammon said that Mr. Edison believed that fifty machines would be sufficient to cover the country.

This oft-quoted statement might

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seem strange coming from a man of Mr. Edison's vision, but it should be borne in mind that up to that date (February, 1896) no pictures of outside scenes had been taken by the Edison Co. The scenes were all such as had been taken in the Edison "Black Maria," as they called it, a sort of open-air, black-lined stage adapted to be rotated so as to face the sun. The necessity for bright sunlight was largely due to the high speed of taking. The pictures were restricted to such as could be taken in the limited space of the small stage, and they were all of vaudeville subjects.

Debut in New York City

Arrangements were made by Raff and Gammon to introduce the machine, or rather its exhibitions, to the New York public, and I was asked to come to New York to supervise the installation and operation of the machine. This I did, and on the evening of April 23, 1896, I gave at Koster and Bial's Music Hall in New York, the first exhibition ever given in a theater of motion pictures as we know them today, embodying, as such exhibitions do, the feature of relatively long periods of rest and illumination of each picture on the film.

I personally operated the machine the first night. All the scenes shown, with one exception, were what might be called vaudeville turns, or stage subjects. A crowded audience applauded each of the scenes with great enthusiasm. The one exception to the stage scenes was an outdoor scene that Raff and Gammon had succeeded in getting from Robert Paul, who by that date was experimenting with motion pictures in England. This scene was of storm-tossed waves breaking over a pier on the beach at Dover, England—a scene that was totally unlike anything an audience had ever before seen in a theater. When it was thrown upon the screen the house went wild; there were calls from all over the theatre for "Edison, Edison, — — speech, speech."

A graphic account of the exhibition was published in the New York *Herald* of May 3, 1896, and previously to that date, on April 4 the New York *Journal* and the New York *World* published long accounts of the exhibition that I had given at Edison's.

Use of Edison's Name

It should be here stated that, by mutual agreement, it was decided that Edison's name should be used in connection with the machine. This was done partly for the commercial advantage of the prestige of his name and partly because he was the producer of and had patents pending covering the films, an essential part of the machine, that he was to supply.

Prior to this, when I had gotten the machine in all its detail into what I considered practicable commercial shape, I applied for a patent on it on February 19, 1896 and selected *Vitascope* as a name for the machine. This name was applied to a projection machine for the first time in this patent application, and it would seem that I added a word to the English language as the word *Vitascope* now appears in most modern dictionaries. The Vitascope, Edison Vitascope, so-called, made an immediate hit and was in great demand.

"Geneva Cross" Movement

Subsequently I invented and patented another projection machine with a greatly superior intermittent movement. This machine is shown in my patent No. 578,185 filed September 25, 1896, issued March 2, 1897. This intermittent movement is known as the "Star Wheel" or Geneva Cross movement, and it superseded all others by 1897 and is in use today in practically every motion picture theater the world over. It was not, however, a part of the Raff and Gammon arrangement, being a somewhat later development.

The intermittent movement has been called (appropriately I think) the "heart" of the motion picture projection machine. In the early days this intermittent movement of my patent No. 578,185 was used in the Edison Projectorscope, the Powers Cameragraph, the Vitagraph, the Lubin machine, the Baird machine, the Simplex machine, and many other early machines.

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PROJECTION LIGHT SOURCES

(Continued from page 17)

by stretching a tape-measure from the edge of the hole in the center of the mirror to the film-plane over the projector aperture, should be maintained to within one inch of the distance specified by the manufacturer. In certain cases, however, it is found that the brightest, most uniform screen light is obtained when the mirror-aperture distance is a trifle shorter than the specified distance, and the actual arc image formed a little beyond the aperture on the projection lens side.

In any case, users of reflector-type lamps should experiment with the mirror-aperture distance, moving the mirror toward or away from the aperture by slight amounts while projecting blank light to the screen. The position of the arc will also have to be shifted forward or backward to bring the spot in focus for the different mirror distances which are tried. The optimum position for the mirror is the one where the brightest and most uniform light is obtained on the screen.

If the mirror has the correct focal length, the optimum mirror-aperture distance thus found will be somewhere inside the permissible 2-inch range. If the best light is obtained by moving the mirror to a point outside this range, advice should be sought from the manufacturer of the lamp.

Proper "Working Distance"

In the case of some reflector lamps, especially the older models, the mirror-holder may be moved longitudinally. Other lamps have fixed holders, requiring the entire lamphouse to be moved on the lamp-table to change the mirror—aperture distance. With condenser-type lamps, the distance from the center of the outer condensing-lens surface to the aperture is specified as the working distance; and this distance depends on the type of condenser-assembly used.

As an example, F:2.3 standard aspheric condensers and F:2.0 high-speed condensers are optional in the Brenkert Model A 4 Supertensity arc-lamp. When the F:2.3 condensers are used, the converger-aperture distance is 15 inches; with the F:2.0 condensers 13⅜ inches. Because of possible small variations in the focal lengths of condensers the manufacturer of this lamp (R.C.A.) permits the complete condenser-assembly (containing two lenses) to be moved slightly toward the positive carbon. This distance must not be shortened any more than is absolutely necessary to obtain correct light distribution, as total screen illumination decreases as the collector-crater distance is shortened.

After the mirror-aperture (or condenser-aperture) distance has been determined, the alignment of all optical elements (mirror, crater, *etc.*) should be checked.

Use of Aligning Rod

The most dependable aligning tool is a long, straight steel rod having approximately the same diameter as the smallest carbon used. A dummy lens barrel having exactly the same diameter as the projection lens barrel is also required. This may be made of aluminum or seasoned hardwood, and it should have a hole of the same diameter as the steel rod bored lengthwise through its center.

When the dummy lens barrel is clamped in place, the glass is removed from the projection port, and the aligning rod inserted into the machine through the dummy lens. Careful measurements are required at the aperture to determine whether the lens holder is properly centered. In old heads designed for silent pictures, the center of the aperture may be displaced 1/20 inch toward the gear side of the mechanism relative to the axis of the lens.

Lamphouse Vertical Positioning

If, however, the aligning rod intersects the center of the aperture, the fire-shutter may be lifted, the rotating occulting shutter turned to get the blade out of the way, and the lamphouse dowser opened. Then the rod is pushed all the way back into the lamphouse to check on the alignment of carbon holder and mirror.

It is sometimes found that the lamphouse is positioned slightly too high or too low. This condition must be corrected by readjusting the supporting brackets. When old-style W.E. Universal bases are used, it may be necessary to place shims between the lamphouse base and the pedestal lamp-table to raise the lamp from ⅛ to ½ inch.

A fairly good idea of the alignment of a lamp may also be gained by simple sighting whenever the construction of the lamp permits a clear view along the optical axis from the rear of the lamphouse. For this purpose an assistant should shine a flashlight into the projection lens.

[TO BE CONTINUED]

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